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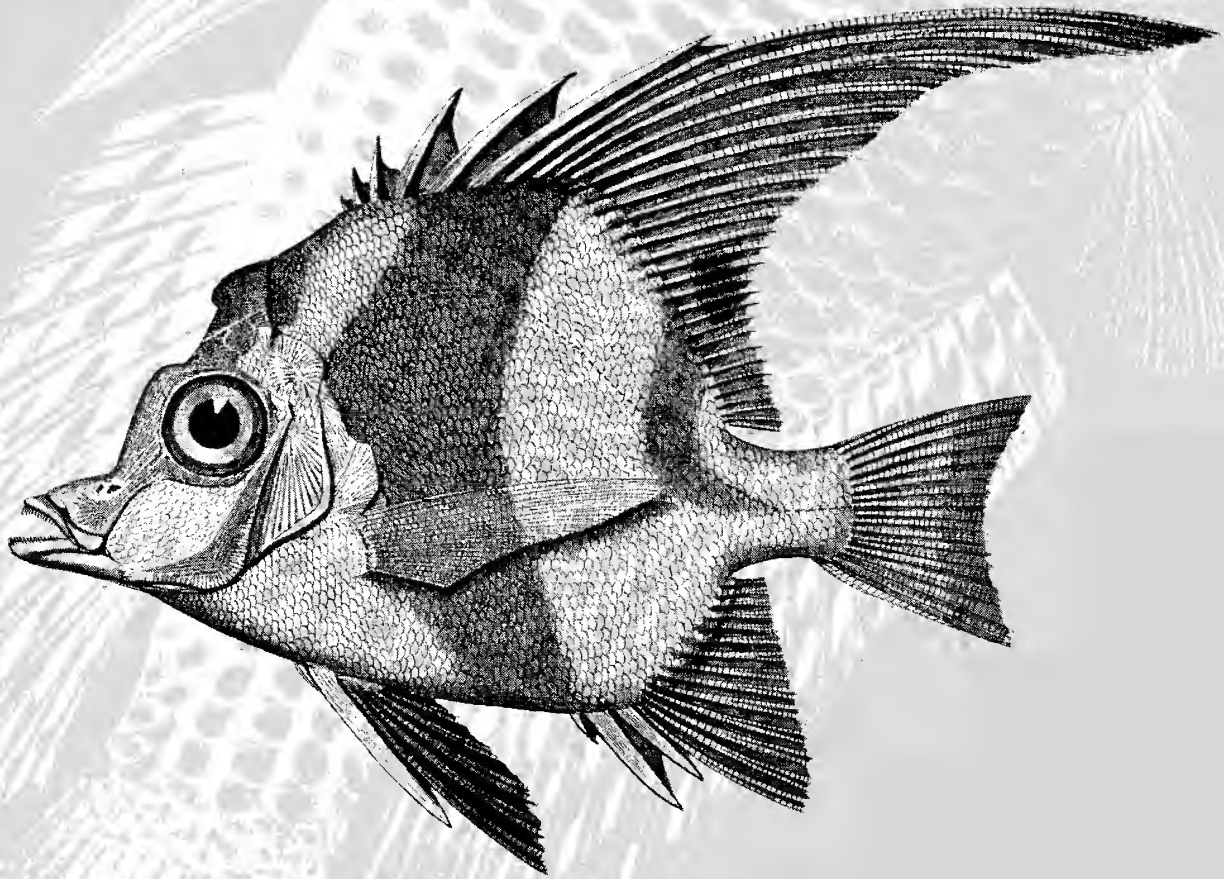

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The **cover** image is of the Australasian Black Spotted Boarfish: *Zanclistius elevatus* (Ramsay & Ogilby, 1888). A number of specimens were trawled by H.M.C.S. *Thetis* in waters off Sydney in the late nineteenth century enabling the Australian Museum Zoologist Edgar R. Waite to illustrate the species in his 1899 publication: *Australian Museum Memoir* IV (1899). The faded impression of a central Queensland freshwater fish—named *Aidapora carteri* by Australian Museum ichthyologist Gilbert Whitley—provides background; this species was also first reported in an Australian Museum publication*: Records of the Australian Museum* volume 19 (1935).

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Records of the Australian Museum (2004) Vol. 56: 139–142. ISSN 0067-1975

The World's Smallest Vertebrate, *Schindleria brevipinguis*, A New Paedomorphic Species in the Family Schindleriidae (Perciformes: Gobioidei)

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ABSTRACT. *Schindleria brevipinguis* n.sp., from the Lizard Island-Carter Reef vicinity of the Great Barrier Reef, Australia and from Osprey Reef nearby in the Coral Sea, is a small, unpigmented gobioid species distinctive in having fewer dorsal- and anal-fin rays and a deeper body with larger eyes than the other described species, *S. pietschmanni* and *S. praematura*. The urogenital papilla of male *S. brevipinguis* has a markedly different shape from those of the other two species. *Schindleria brevipinguis* apparently provides an even more extreme example of paedomorphosis than its congeners, and with males maturing by 7 mm and the largest specimen only 8.4 mm, it almost certainly is the world's smallest fish and smallest vertebrate.

WATSON, WILLIAM, & H.J. WALKER JR., 2004. The world's smallest vertebrate, *Schindleria brevipinguis*, a new paedomorphic species in the family Schindleriidae (Perciformes: Gobioidei). *Records of the Australian Museum* 56(2): 139–142.

Schindleriidae, a family of small, paedomorphic, marine gobioid fishes (Johnson & Brothers, 1993), is widely distributed in warm-water reef habitats of the Indian and Pacific Oceans (e.g., Bruun, 1940; Jones & Kumaran, 1964; Sardou, 1974; Ozawa & Matsui, 1979; Belyanina, 1989; Harris & Cyrus, 1996; Landaeta *et al.*, 2002). *Schindleria praematura* (Schindler, 1930) and *S. pietschmanni* (Schindler, 1931) originally were described as *Hemiramphus* species; Giltay (1934) subsequently placed them in their own genus and family. To date, these two species remain the only described members of the family, although Yoshino *et al.* (2000) and Kon & Yoshino (2002) have suggested that Schindleriidae probably contains many species.

In 1979, while conducting ichthyoplankton research in the Lizard Island-Carter Reef vicinity of the Great Barrier Reef, Queensland, J.M. Leis and party collected a small *Schindleria* specimen that clearly differed from *S. praematura* and *S. pietschmanni*. Four additional specimens were collected from the Lizard Island-Carter Reef vicinity from 1981–1983, and in 1988 another was collected at Osprey Reef, nearby in the Coral Sea. These six specimens are described here as a new *Schindleria* species.

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Materials and methods

Counts, measurements, and descriptions of general body shape follow Leis & Carson-Ewart (2000). All counts and measurements were made at 25× or 50× magnification using a binocular microscope equipped with an ocular micrometer. All measurements are in mm and standard length (SL) is used throughout. Length of the urogenital papilla is measured from the body margin, along the axis of the papilla. Specimens were neither cleared and stained nor dissected; thus counts of vertebrae, gill-rakers, cerato-branchial teeth, and branchiostegal rays were made only when those structures were easily discernible. Illustrations were made with the aid of a camera lucida. Institutional abbreviations follow Leviton *et al.* (1985). Comparative material examined: *Schindleria pietschmanni*, SIO 91–140 (13: 4.4–13.6 mm); *S. praematura*, AMS I.20970-009 (10: 4.0–10.2 mm); SIO 91–140 (2: 13.9–15.4 mm).

Schindleria brevipinguis n.sp.

Fig. 1

Type material. HOLOTYPE: AMS I.23552-006, 8.4 mm, a mature female, collected in a plankton tow by J. Leis and party on 18 January 1982, from the vicinity of Carter Reef, Queensland, Australia (14°33.5'S 145°35'E). PARATYPES (all from Queensland, Australia): AMS I.23729-003 (1: 5.1 mm, immature, probably male, lee of Carter Reef, 14°33'S 145°35'E); AMS I.26323-003 (1: 6.6 mm, male, Carter Reef, 14°33.5'S 145°35'E); AMS I.30632-003 (1: 6.5 mm, male, Osprey Reef lagoon, 13°47–55'S 146°35–40'E); QM I.33614 (1: 7.7 mm, male, Carter Reef, 14°35'S 145°35'E); SIO 03–35 (1: 6.9 mm, male, Carter Reef, 14°34'S 145°35'E).

Diagnosis. A small, stout, unpigmented *Schindleria* species, largest specimen 8.4 mm; body depth at pectoral-fin origin 9–12% of standard length and at anal-fin origin 9–14% SL. Dorsal-fin rays 13, anal-fin rays 10–11; first dorsal-fin ray at myomere 18–20 and first anal-fin ray below dorsal-fin ray 4. Vertebrae 20 + 15–16 = 35–36, myomeres 19–20 + 14–16 = 34–36. Premaxillae and dentaries lack teeth. Males have a rod-like, flexible urogenital papilla lacking lobes, projections, or accessory papillae, with distal half tapering to a blunt point and usually anteriorly directed.

Description. Dorsal-fin rays 13 (Table 1), anal-fin rays 10–11, dorsal- and anal-fin rays spaced at intervals of approximately one ray per myomere; first dorsal-fin ray at myomere 18–20 (mode = 19), last ray at myomere 28–33 (31); first anal-fin ray at myomere 22, just before to just behind dorsal-fin ray 4 (usually below D 4), last ray below last dorsal-fin ray; pectoral-fin rays 14–16 (14); pelvic fins absent; principal caudal-fin rays 7 + 6, procurrent rays 5–6 + 5–6; all fin-rays unbranched; vertebrae 20 + 15–16 (20 + 16); myomeres 19–20 + 14–16 (20 + 16); branchiostegal rays 5; gill-rakers and teeth absent; gas bladder at myomeres 9–13 (10–12).

Head small, length averages 18% SL (Table 2); snout short, length averages 23% of head length (HL); eye moderately large, slightly oval to round, length averages 30% HL and height averages 32% HL; gut moderately long and straight, preanal length averages 64% SL; dorsal-fin origin slightly anterior to level of anus, predorsal fin length averages 61% SL; caudal peduncle length averages 11% SL; elongate, but moderately deep-bodied compared with *S. pietschmanni* and *S. praematura*, body depth at pectoral-fin origin averages 10% SL and at anal-fin origin 12% SL; unornamented, rod-like urogenital papilla of male tapers to a blunt point, usually with distal half anteriorly directed, resulting in a somewhat scythe-shaped appearance in lateral view, length in mature specimens averages 6% SL.

Table 1. Selected meristic characters for *Schindleria brevipinguis*. Parenthetical values are approximate.

	holotype	paratypes				
	AMS I.23552-006	AMS I.23729-003	AMS I.26323-003	AMS I.30632-003	QM I.33614	SIO 03–35
dorsal-fin rays	13	13	13	13	13	13
anal-fin rays	10	11	11	11	10	10
pectoral-fin rays	14	>12*	(14)	14	14	16
caudal fin: principal rays	7+6	7+6	7+6	7+6	7+6	7+6
caudal fin: procurrent rays	5+5	5+5	6+6	6+5	6+5	5+5
branchiostegal rays	—	—	5	—	5	5
gill-rakers	—	(0)	(0)	0	0	—
vertebrae	20+15	—	(20)+16	—	20+16	—
myomeres	20+14	19+16	20+16	20+16	20+16	19+16
1st D ray at myomere	18	20	20	19	19	19
last D ray at myomere	28	30	33	31	31	31
1st A ray below D ray	4	4	4	4	4	4

* incomplete

Table 2. Measurements (in millimetres) of *Schindleria brevipinguis*. Parenthetical values are approximate.

measurement	holotype	paratypes				
	AMS I.23552-006	AMS I.23729-003	AMS I.26323-003	AMS I.30632-003	QM I.33614	SIO 03–35
TL	9.1	5.8	7.3	7.2	8.6	7.6
SL	8.4	5.1	6.6	6.5	7.7	6.9
predorsal fin L	5.5	3.1	4.1	3.8	4.7	4.0
PAL	6.0	3.2	4.0	4.1	4.8	4.4
HL	1.2	1.1	1.2	1.2	1.4	1.3
postocular HL	0.5	0.5	0.6	0.6	0.7	0.6
snout L	0.3	0.2	0.3	0.3	0.3	0.3
ED (width × height)	0.4×0.4	0.3×0.4	0.4×0.4	0.4×0.4	0.4×0.5	0.4×0.4
BD (at pectoral-fin origin)	0.7	0.6	0.7	0.7	0.9	0.8
BD (at anal-fin origin)	0.8	0.6	0.9	0.8	1.0	0.9
pectoral-fin base L	0.5	0.3	0.4	(0.3)	0.5	0.5
pectoral-fin base width	0.4	0.3	0.4	0.3	0.5	0.4
caudal peduncle L	0.8	0.6	0.8	0.7	0.9	0.8
min. caudal peduncle depth	0.2	0.2	0.2	0.2	0.2	0.2
length of urogenital papilla		0.2	0.5	0.3	0.5	0.4
HW	0.7	0.6	0.7	0.7	0.8	0.7

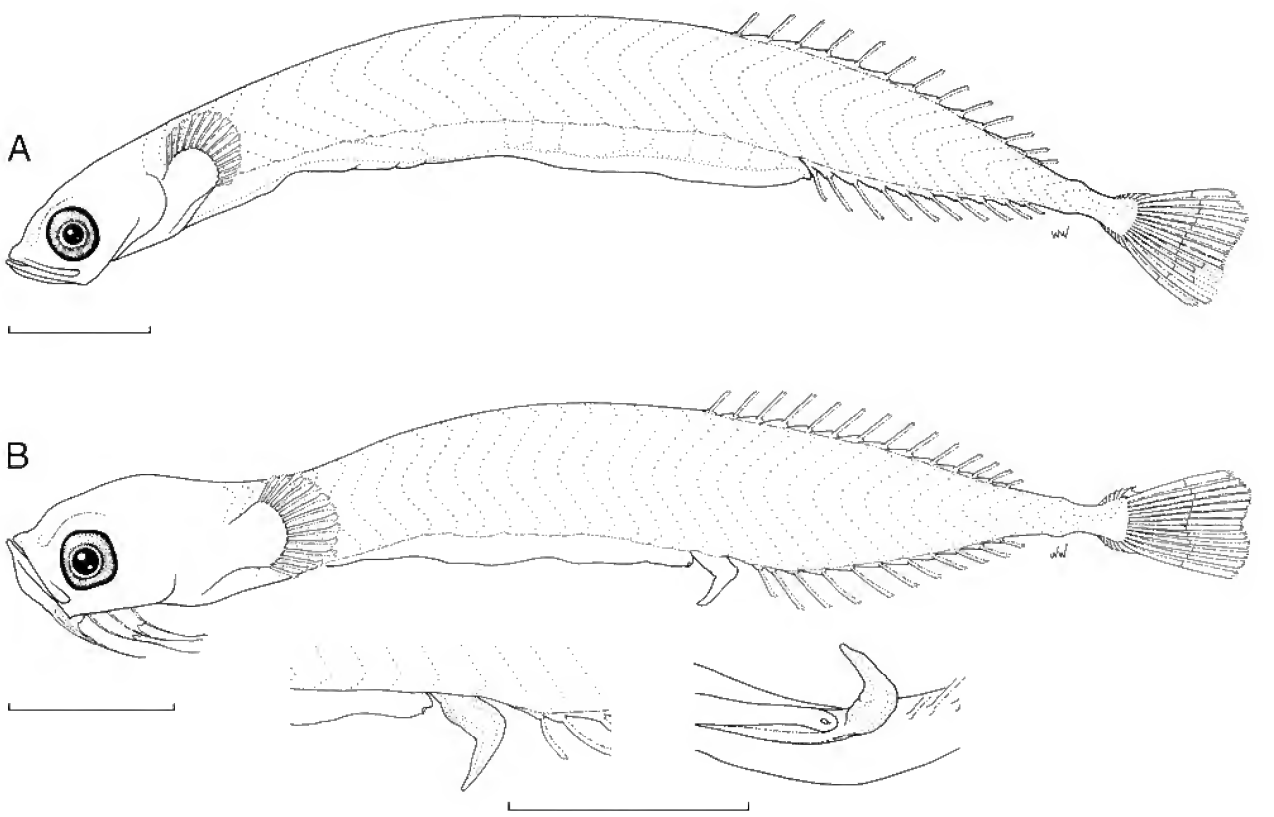

Fig. 1. *Schindleria brevipinguis* n.sp. (*A*) Holotype, AMS I.23552-006 (8.4 mm, female), from vicinity of Carter Reef, Great Barrier Reef, Queensland, Australia; (*B*) paratype, AMS I.26323-003 (6.6 mm, male; note that branchiostegal area is somewhat damaged) from Carter Reef vicinity, Great Barrier Reef. Enlarged lateral (left) and ventral (right) views of urogenital papilla are shown below paratype. Scale bar = 1 mm.

All specimens unpigmented apart from the eyes. A small species: the largest specimen, a mature female bearing approximately 12 large, somewhat irregularly shaped ova (mean diameter 0.4 mm, range about 0.3–0.5 mm), is 8.4 mm.

Etymology. From the Latin *brevis*, short, referring to the small size of this species, and *pinguis*, stout, referring to the deeper, broader body compared with the other *Schindleria* species. A common name suggested for the family is infantfishes, and for the species, stout infantfish.

Distribution. Currently known only from the Lizard Island-Carter reef area (c. 14°33–35'S 145°35'E) of the Great Barrier Reef, Queensland, Australia, and from Osprey Reef (13°47–55'S 146°35–40'E), nearby in the Coral Sea. Specimens were collected in oblique plankton net tows from the Great Barrier Reef and Osprey Reef lagoons in waters ranging from 15–30 m deep.

Remarks. Yoshino *et al.* (2000) suggested that at least eight *Schindleria* species, all different from Schindler's original descriptions of *S. pietschmanni* and *S. praematura*, occur in the Ryukyu Islands, Japan. These were distinguished primarily by the morphology of the urogenital papilla of male specimens. Because females have less well-developed urogenital papillae, fewer types were identifiable; thus morphology of the male urogenital papilla was considered a key character for recognition of *Schindleria* species. In the case of *Schindleria brevipinguis* the male urogenital papilla is not critical to identification; both males and females are readily distinguishable from *S. pietschmanni* and *S. praematura* on the basis of several other morphological and meristic characters. Most useful among these are the number of dorsal- and anal-fin rays and relative positions of the dorsal and anal fins, as noted in the key above. *Schindleria brevipinguis* has a deeper body, averaging 10% and 12% SL at pectoral- and anal-fin origins, vs. 5% and 6%, respectively, in *S. praematura* and 6% at both locations in *S. pietschmanni*. Schindler (1930, 1931) gave slightly higher values for relative body depth of *S. praematura* and *S. pietschmanni*: 5.9—6.8% SL and 6.1—7.5% SL, respectively, both still smaller than the relative body depth of *S. brevipinguis*. *Schindleria brevipinguis* has slightly larger eyes than *S. pietschmanni*, averaging about 30% HL vs. about 25% HL, and fewer preanal vertebrae than *S. praematura*: 20 vs. 23—25 (Schindler, 1930), respectively. *Schindleria brevipinguis* apparently lacks teeth in the jaws while the other two have small, but readily discernible teeth in both jaws. Both *S. pietschmanni* and *S. praematura* typically have pigment dorsally on the gas bladder, but *S. brevipinguis* does not. The urogenital papilla of male *S. brevipinguis* is distinctly different from the papillae of male *S. praematura* and *S. pietschmanni* (cf. Fig. 1; Jones & Kumaran, 1964, fig. 2; Sardou, 1974, fig. 8) and thus is a useful ancillary character for identification of male specimens. Note that the urogenital papilla of male *S. praematura* from Hawaii we examined differs from that shown by Sardou (1974, fig. 4), and by Bruun (1940, fig. 2) for specimens from Madagascar and Samoa, respectively.

Key to the described species of *Schindleria*

1 Anal-fin rays 10–14, usually 10–12; first anal-fin ray behind position of dorsal-fin ray 3, usually under dorsal-fin ray 4–11 2

—— Anal-fin rays 15–18, usually 15–16; first anal-fin ray under dorsal-fin ray 1–3 (Indo-West Pacific) ..... *S. pietschmanni*

2 Dorsal-fin rays 13; first anal-fin ray just before to just behind (usually under) dorsal-fin ray 4 (Queensland, Australia) ..... *S. brevipinguis* n.sp.

—— Dorsal-fin rays 16–22, usually 19–21; first anal-fin ray under dorsal-fin ray 7–11 (Indo-Pacific) ..... *S. praematura*

Schindleria brevipinguis may represent an even more extreme example of paedomorphosis than *S. pietschmanni* and *S. praematura*. The apparent lack of premaxillary and dentary teeth, of teeth on the ceratobranchials, and of branched caudal-fin rays in *S. brevipinguis* compared with the presence of all these in the other two species suggests that somatic development is more truncated in *S. brevipinguis*. In contrast to *S. brevipinguis, S. pietschmanni* has premaxillary teeth late in the larval stage by about 4.5 mm, dentary teeth by c. 5 mm, and the central 11 principal caudal-fin rays are branching in the juvenile stage by c. 7 mm. *Schindleria praematura* has teeth in both jaws by 4.0 mm and the central caudal-fin rays begin to branch at about 6.0 mm. The gas bladder shifts posteriorly with development in both *S. pietschmanni* and *S. praematura*, from a mid-gut location in larvae to above the posterior third of the gut in adults (Watson, 2000); the more anterior, mid-gut gas bladder location in adult *S. brevipinguis* may provide additional evidence for more truncated development.

Schindleria brevipinguis, which matures at 7–8 mm, almost certainly is the world's smallest fish and smallest vertebrate. Previously, the record for shortest fish was held by the gobiid, *Trimmatom nanus*, with females maturing at about 8 mm and males and females averaging 8.6 and 8.9 mm, respectively (Winterbottom & Emery, 1981). *Schindleria brevipinguis* males mature at 6.5–7 mm, and the largest known specimen of either gender is only 8.4 mm. Based on Bruun's (1940) information on length and weight of *S. pietschmanni* and *S. praematura*, a mature *S. brevipinguis* would be expected to weigh 2 mg or less, and in fact a lightly blotted, formalin-preserved, 6.5 mm male (AMS I.30632-003) weighed 0.7 mg. Thus *S. brevipinguis* is undoubtedly the lightest vertebrate.

ACKNOWLEDGMENTS. We are grateful to Jeff Leis who collected the specimens, brought them to our attention, and graciously allowed us to describe them, and to Mark McGrouther of the Australian Museum and Jeff Johnson of the Queensland Museum for the loan of specimens. Phil Hastings and Jeff Leis offered helpful suggestions that improved the manuscript.

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A New Genus and Species of Congrid Eel (Teleostei: Anguilliformes: Congridae) from Western Australia

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ABSTRACT. A new genus and species of congrid eel, *Castleichthys auritus*, is described from a single specimen collected from 396 m off northwestern Australia. It belongs to the subfamily Congrinae and is characterized by a slender and flexible tail, a free flange on the upper lip, no plicae or other ornamentation on skin of head, large eye, uniserial maxillary and mandibular teeth, and conspicuous black pectoral fins. The vertebral formula is 15–36–128.

SMITH, DAVID G., 2004. A new genus and species of congrid eel (Teleostei: Anguilliformes: Congridae) from Western Australia. *Records of the Australian Museum* 56(2): 143–146.

The Congridae constitute a diverse and speciose eel family (Anguilliformes) whose members inhabit mostly continental shelf and slope waters in tropical and subtropical latitudes worldwide. Congrid eels of the Atlantic (Blache & Bauchot, 1976; Smith, 1989) and Japan (Asano, 1962) are fairly well known, but other areas have not been adequately studied. The eel described here differs from all previously known species of Congridae to such an extent that it is placed in a new genus.

Materials and methods

Counts, measurements, and abbreviations are as given in Smith (1989: 461). The holotype is deposited in the CSIRO collection in Hobart, Tasmania.

Castleichthys n.gen.

Type species. *Castleichthys auritus* n.sp.

Diagnosis. Body moderately elongate; preanal length less than 40% TL; tip of tail slender and flexible, but not greatly attenuate or filiform; pectoral fin well developed; dorsal origin slightly behind tip of appressed pectoral fin; dorsal- and anal-fin rays segmented; jaws equal, rictus below middle of eye; flange present on upper lip; skin of head without papillae or plicae; eye relatively large; posterior nostril at mid-eye level. Teeth small, not caniniform or molariform; maxillary teeth uniserial, mandibular teeth uniserial for most of length.

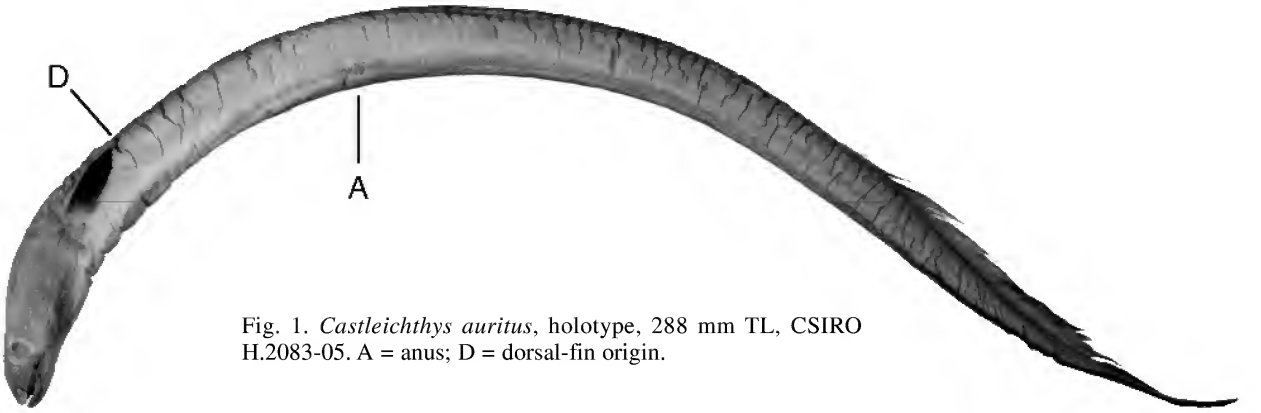

Fig. 1. *Castleichthys auritus*, holotype, 288 mm TL, CSIRO H.2083-05. A = anus; D = dorsal-fin origin.

Etymology. Named for the late P.H.J. Castle, who located the specimen described here and recognized its novelty, but was unable to complete the description himself; in recognition of his many contributions to our knowledge of eels and eel larvae. In combination with the Greek *ichthys*, fish; masculine.

Castleichthys auritus n.sp.

Figs. 1–4

Type material. HOLOTYPE: CSIRO H.2083-05, female, 288 mm; Western Australia, northeast of Rowley Shoals, 16°53'S 120°21'E, depth 396 m, by prawn trawl, S. Morris (CSIRO), vessel "Striker", 11 April 1989.

Description. Measurements in mm, with proportions in parentheses: TL 288, preanal length 99 (34% TL), predorsal length 52.5 (18% TL), head length 34 (12% TL), depth at anus 15.5 (5.4% TL), snout length 7.9 (23% head), horizontal eye diameter 5.4 (16% head), snout to rictus 10.2 (30% head), gill opening 4.7 (14% head), interbranchial 9.1 (27% head), pectoral-fin length 16.0 (47% head). Meristic characters: preanal lateral-line (LL) pores 34, preoperculomandibular (POM) pores 8, infraorbital (IO) pores 5, supraorbital (SO) pores 2, supratemporal commissure (STC) pores 0. Predorsal vertebrae 15, preanal vertebrae 36, total vertebrae128.

Body moderately elongate, more or less uniform in depth over most of its length, round in cross section anteriorly, becoming compressed posteriorly; tip of tail slender and flexible but not greatly attenuate or filiform; anus near anterior third of total length. Dorsal-fin origin slightly behind tip of appressed pectoral fin, continuous around tip of tail with anal fin, which begins immediately behind anus; fin rays segmented. Pectoral fin well developed, long, broad, conspicuously black. Gill opening relatively large, nearly vertical, upper end opposite middle of pectoral-fin base. Abdominal cavity ending shortly posterior to anus. Myorhabdoi absent (from radiograph).

Head deepest at posterior end near gill opening, dorsal profile nearly flat from occiput to point slightly anterior to posterior nostril, then deflected ventrally to tip of snout. Mouth terminal, snout and lower jaw about equal, rictus below middle of eye. Eye well developed, relatively large. Anterior nostril tubular, at edge of lip; posterior nostril a simple round pore with a slightly raised rim, at mid-eye level, about 2–3 nostril diameters from anterior edge of eye. Upper lip with a free, upturned flange, beginning immediately behind first IO pore, which borders base of anterior nostril, and ending below anterior margin of eye. Lower lip with a downturned flange. Tongue free, long, and

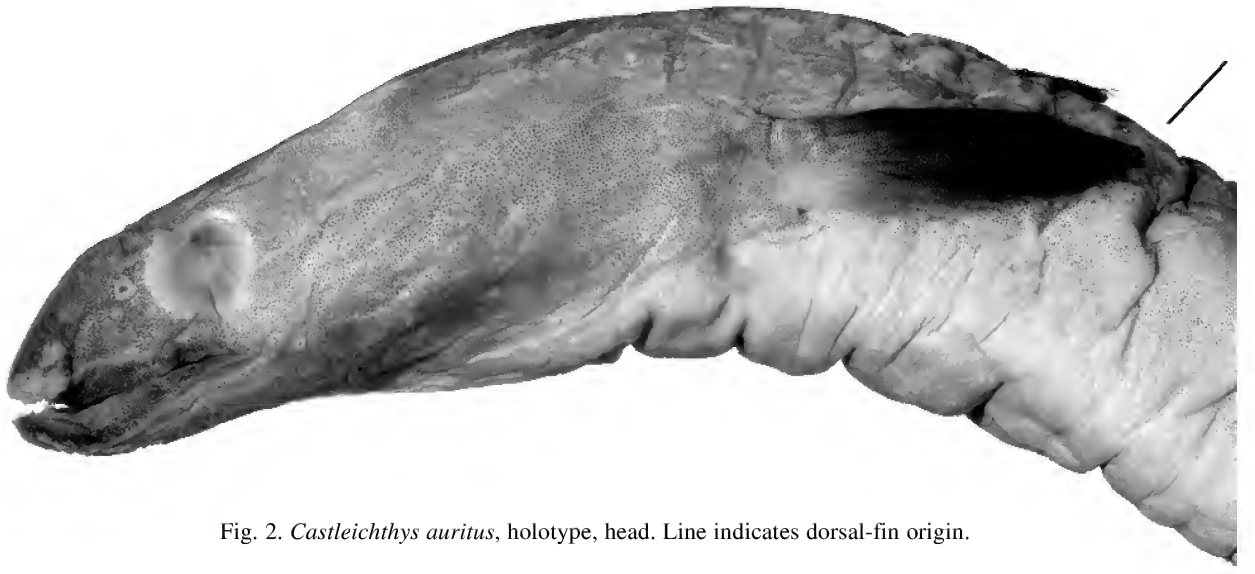

Fig. 2. *Castleichthys auritus*, holotype, head. Line indicates dorsal-fin origin.

broad, when raised filling nearly entire roof of mouth medial to teeth. Skin of head smooth, without papillae or plicae.

Lateral line complete, 34 pores before anus. Cephalic pores (Fig. 3) difficult to see, in part because of damage to head. Two SO pores visible, both relatively large: one on edge of upper lip before anterior nostril; one on side of head directly above anterior nostril; ethmoidal pore not apparent. IO canal with five pores: a conspicuous pore immediately adjacent to posterior edge of base of anterior nostril and immediately anterior to beginning of labial flange; a pore on side of jaw just above flange, about midway between anterior and posterior nostril; a pore on side of jaw just above flange, directly below posterior nostril; a pore on side of jaw at posterior end of flange, below anterior margin of eye; a pore behind rictus, under or slightly behind a vertical through posterior edge of eye; no pores behind eye. Eight pores visible in POM canal, five before rictus and three behind rictus. No STC pores visible.

Teeth (Fig. 4) small, conical to peg-like in appearance. Intermaxillary region damaged, number and placement of teeth somewhat uncertain; teeth conical, appear to be arranged in two transverse rows. Vomerine teeth smaller, conical, in a slightly elongate patch. Maxillary teeth peg-like in appearance, with bevelled edges, uniserial but not closely appressed or forming a cutting edge. Mandibular teeth conical anteriorly, peg-like laterally, mostly uniserial but biserial at anterior end of jaw.

Preserved coloration. Light gray-brown, paler ventrally. Dorsal and anal fins with body colour anteriorly, becoming dark toward posterior part of tail, progressively darker posteriorly, becoming black at tip of tail. Pectoral fins conspicuously black. Gill opening, inside of mouth, and peritoneum pale.

Remarks. The anterior end of the snout and lower jaw have been crushed and slightly caved in, pushing the tip slightly to the left. The main damage on the snout was to the tip of the intermaxillary plate and the teeth that it bears. The lower jaw has been broken at the tip. For that reason, the precise number and arrangement of teeth at the anterior end of both jaws are somewhat uncertain. The specimen is a female with enlarged gonads; the eggs are contained within the ovary.

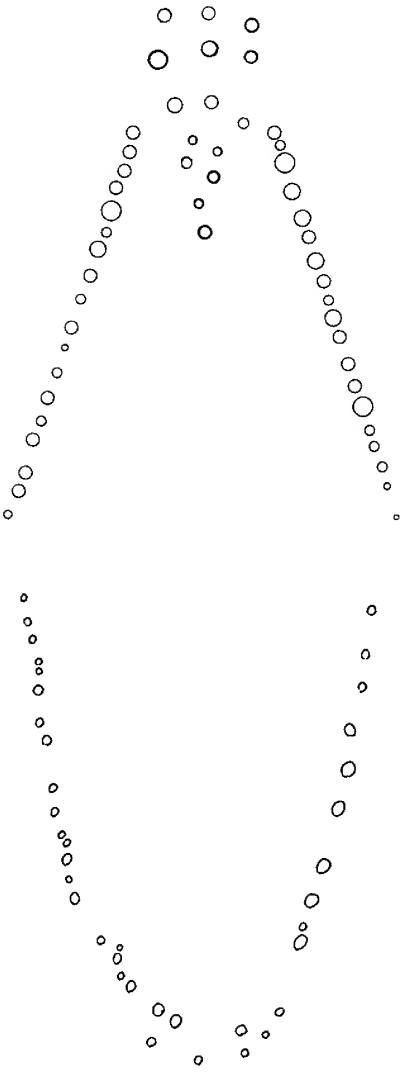

Fig. 4. Pattern of upper and lower teeth of *Castleichthys airitus*.

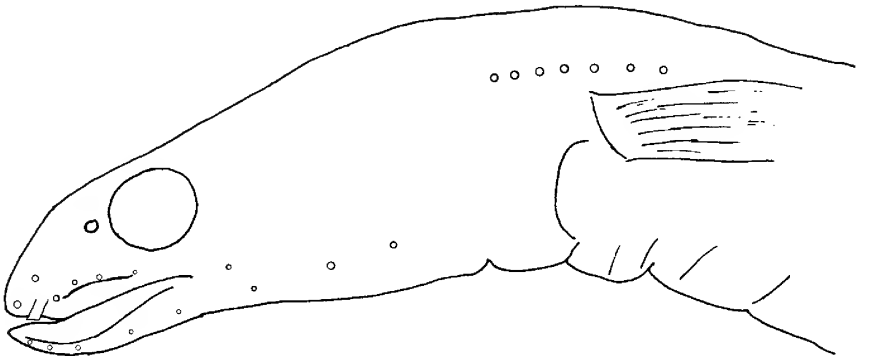

Fig. 3. Head of *Castleichthys auritus*, showing location of head pores.

Etymology. Latin *auritus*, eared; in reference to the large, conspicuous pectoral fins, which resemble the ears of a rabbit or a mule. An adjective.

Distribution. The only known specimen was collected on the continental slope off the northwestern coast of Australia, at a depth of 396 m.

Comparisons and relationships. The relatively short preanal length (less than 40% TL), slender and flexible tail, segmented dorsal- and anal-fin rays, and lack of myorhabdoi place this species within the subfamily Congrinae, as defined by Asano (1962) and Smith (1989). Superficially, it somewhat resembles members of *Macrocephenchelys* Fowler, 1934, especially in the relatively short snout and long postorbital region, and the large pectoral fins. The species of *Macrocephenchelys*, however, have no upper labial flange, and the lips are strongly plicate; in addition, they have multiserial teeth. The presence of a labial flange distinguishes the new species from most genera of Congrinae, except for *Congriscus* Jordan & Hubbs, 1925, *Conger* Bosc, 1817, *Gnathophis* Kaup, 1860, *Rhynchoconger* Jordan & Hubbs, 1925, and *Blachea* Karrer & Smith, 1980. *Congriscus* and *Gnathophis* have blunt, stiffened tail tips, quite unlike the slender tail in the new species. In *Conger*, the pectoral fin is smaller, usually 25–35% of head length, and not conspicuously black; the maxillary teeth are closely appressed and form a cutting edge; an adnasal pore (at the end of a short branch ascending dorsally from the anterior end of the IO canal) and at least one STC pore are present; the labial flange is more extensive, reaching nearly to the rictus; and the tongue is smaller. In *Rhynchoconger*, the flange is greatly reduced, often to a near vestige; the snout conspicuously overhangs the lower jaw, leaving the intermaxillary tooth patch exposed when the mouth is closed; the tail is greatly attenuate; and the teeth are in granular patches. *Blachea* has the snout distinctly overhanging the lower jaw, the tips of the branchiostegals protruding freely through the gill opening, and the lateral line enlarged and opening through a double series of pores.

If the new species is run through the key to genera of Congridae in the western central Pacific (Smith, 1999: 1682), it comes out closest to *Conger*, in couplet 13a. Although the maxillary and mandibular teeth are in one row (like *Conger*) rather than in bands, they do not form a cutting edge as they do in *Conger*. The specimen further differs from *Conger* in the characters mentioned in the previous paragraph, and its overall appearance is quite different. Based on the characters available for study, the new species does not fit into any of the existing congrid genera. With only a single specimen available, osteological characters (besides those visible on the radiograph) could not be investigated. Further studies on the relationships of this species must await the capture of additional specimens.

ACKNOWLEDGMENTS. My late friend and colleague, P.H.J. Castle of Victoria University, Wellington, New Zealand, informed me of this specimen and had it transferred to me when he was unable to continue his work. A. Graham, collection manager at CSIRO, Hobart, sent me the specimen on loan.

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Five New Fish Species of the Genus *Alabes* (Gobiesocidae: Cheilobranchinae)

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ABSTRACT. Five new species of shore-eels in the genus *Alabes* are described from southern Australia: *A. elongata* (Western Australia); *A. gibbosa* (Western Australia); *A. occidentalis* (Western Australia); *A. obtusirostris* (Victoria and Western Australia); and *A. scotti* (New South Wales and Tasmania). The first three species inhabit shallow nearshore reef and/or weed areas, whereas the last two have been found only on soft bottoms in deeper coastal waters (24–65 m). This brings the total number of described species to nine (previously known species are *A. dorsalis* [Richardson], *A. parvula* [McCulloch], *A. brevis* Springer & Fraser, and *A. hoesei* Springer & Fraser). Two of the new species, *A. elongata* and *A. occidentalis*, appear to be western sister species of southeastern Australian forms (*A. dorsalis* and *A. parvula*, respectively), whereas one new Western Australian species, *A. gibbosa*, is similar to another western form, *A. brevis*. The apparent relationships of the remaining two new species, *A. obtusirostris* and *A. scotti*, are obscure. The former is similar to *A. dorsalis* but lacks a rudimentary pelvic fin, whereas the latter shows some similarities to *A. parvula* but possesses a more pointed head and a unique coloration. A key to *Alabes* species is provided.

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Members of the Australian endemic gobiesocid subfamily Cheilobranchinae—commonly referred to as shore-eels—are small, elongate fishes belonging to a single genus *Alabes* (Cloquet, 1816). They inhabit temperate waters, forming a unique assemblage of what was first thought to represent a variety of synbranchid eel. Springer & Fraser (1976) showed, however, that these eel-like fishes should be included with the Gobiesocidae. Their review recognized four species: *Alabes dorsalis* (Richardson, 1845), *A. parvula* (McCulloch, 1909), *A. brevis* and *A. hoesei*, the last two described as new. Springer & Fraser (1976) suggested that a single specimen of *Alabes* from Norfolk Island off eastern Australia might also represent a new species but were unwilling to describe it based on a single specimen. All members of the genus possess a small ventral slit-like gill opening, have no pectoral fins, either have small, rudimentary pelvic fins or lack them entirely, and their dorsal and anal fins are represented by fin folds that lack fin-rays and are continuous with a small caudal fin that does have fin-rays. Unlike clingfishes, they do not possess the characteristic ventral sucking disc, although one species, *Alabes dorsalis*, was shown by Springer & Fraser (1976: fig. 11d) to have what appears to be a rudimentary disc. Nevertheless, one unique osteological character is shared between clingfishes and shore-eels: the supracleithrum bears a concave process at its outer end that articulates with a

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Table 1. Distinguishing characters of the species of *Alabes* (see methods for abbreviations).

character	*dorsalis*	*elongata* n.sp.	*brevis*	*gibbosa* n.sp.	*hoesei*	*parvula*	Norfolk I species	*occidentalis* n.sp.	*scotti* n.sp.	*obtusirostris* n.sp.
pelvic fins	present	present	rudiment	rudiment	absent	absent	absent	absent	absent	absent
gill slit	large	large	medium	medium	small	small	small	small	small	large
POP	1	1	2 (wide)	2 (wide)	2 (close)	1	1	1	1	0
ANP	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
PNP	no	no	no	yes	yes	no	no	no	no	no
LP	yes	no	yes	yes	yes	yes	no	no	no	no
vertebrae (total)	66–78	74–78	60–61	68–69	63–71	63–74	71	65–69	68	70
vertebrae (precaud)	22	22	22	18	16	17–19	?	16–17	22	23
last epipleural	21–27	28	21–22	20	14–16	16–20	20	15–17	26	40
caudal rays	7–9	6–9	9–12	9–11	7–8	4–6	0?	4–6	4–5	8
body transparent	no	no	no	no	yes	yes	?	yes	no	?
gut extension	—	—	—	—	long	short	?	short	—	—
tail length	short	long	short	long	long	long	short	long	long	long
dorsal origin	over anus	post. anus	post. anus	over anus	over anus	over anus	post. anus	over anus	ant. anus	post. anus
longest specimen	120 mm	92 mm	36 mm	92 mm	44 mm	47 mm	32 mm	40 mm	46 mm	46 mm
distribution	NSW–SA	WA	WA	WA	NSW–WA	Qld,NSW,Tas	Norfolk I	WA	NSW–Tas	Vic, WA
habitat	reef & weed	reef & weed	reef & weed	seagrass	reef & weed	reef & weed	reef & weed?	seagrass	deep water	deep water

convex condyle on the anterior surface of the cleithrum. Interestingly, all species of *Alabes* and most clingfishes apparently turn reddish when placed in formalin, although this is not unique to these two groups. On the basis of Springer & Fraser's work, *Alabes* remains in the Gobiesocidae (Eschmeyer, 1990).

The current study commenced in the late 1970's after the senior author collected several apparently new species of *Alabes* from southern Western Australia. While reviewing the literature, it was noted that *A. dorsalis*, a species that is common in the temperate nearshore reefs of southeastern Australia, has a type locality of tropical northwestern Australia. No other evidence could be found to suggest that members of the genus have ever inhabited tropical waters, throwing into doubt the accuracy of the type locality. If, on the other hand, the type specimens had been collected from southwestern Australia and labelled incorrectly, then one of the supposed new species might in fact be the true *A. dorsalis*, and thus the southeastern form would require renaming. Furthermore, the type locality for *Cheilobranchus aptenodytum* Richardson (= *A. dorsalis* [after Springer & Fraser, 1976]) was given as Penquin Island, latitude 72°S, which also appeared to represent an error as no additional specimens of the genus have since been discovered so far to the south. It seemed appropriate, therefore, to again review the genus to sort out these problems.

Like other clingfishes, members of *Alabes* lose their colour patterns quickly after preservation. As coloration in the family is often sexually dimorphic and geographically variable, it was necessary to obtain fresh material to discover colour variations of the various forms. Collections were made across all southern Australian States, and much of the available material housed in Australian and European Museums was examined. We found, firstly, that Australian waters are inhabited by at least nine species of *Alabes*, five of which were undescribed, secondly, that the types of *A. dorsalis* were more likely collected in Tasmania or Victoria than Western Australia, and thirdly, that the type of *Cheilobranchus aptenodytum* is in such a poor state that it is unidentifiable. In addition, we concur with Springer & Fraser (1976) that the single specimen of *Alabes* from Norfolk Island may also be undescribed, but the lack of additional material still precludes a firm decision on this. Thus descriptions of the five new species of *Alabes* are presented here as a contribution to the volume on new Australian fishes. Despite the inclusion of a table of diagnostic characters for the genus (see below), a complete review of *Alabes* is still progressing and will be published later.

Materials and methods

Methods of counting and measuring follow those of Hutchins (1983) with the following exceptions: origin of the dorsal and anal fins are taken from where the fin fold concerned makes an obvious elevated rise away from the specimen's body; a low dorsal or ventral skin ridge may precede the fins and care should be taken not to include this feature in the measurement (generally the fin fold is more translucent than the skin ridge as there is less musculature associated with the former); all measurements pertaining to the eye are measured to the edge of the bony orbit; gill slit length is the maximum dimension of the opening, and is measured laterally between the two

Key to the species of *Alabes*

1 Pelvic-fin rudiment present, located on ventral surface just behind level of gill opening 2

—— Pelvic-fin rudiment absent 5

2 Pelvic-fin rudiment moderate in size, fin rays present; postocular pore 1 3

—— Pelvic-fin rudiment small, pelvic fin rays (if present) not visible; postocular pores 2, usually widely separated 4

3 Body relatively robust (depth 9.3–11.6 in SL); dorsal fin relatively high, continued anteriorly as a prominent fin fold to area above urogenital opening (snout to origin of dorsal fin 2.0–3.5 in SL); blackish circular blotches often present on middle of side of large adults (NSW, Vic, Tas, and SA) ..... *A. dorsalis*

—— Body relatively slender (depth 12.5–14.9 in SL); dorsal fin relatively low, origin falling well short of point over urogenital opening (snout to origin of dorsal fin 1.5–2.4 in SL); no dark circular blotches on side of large adults (WA) ..... *A. elongata* n.sp.

4 Head relatively large, length 6.7–8.4 in SL; posterior nasal pore absent; back not usually hunchbacklike, although ripe female may have this appearance; maximum SL 36 mm (WA) ..... *A. brevis*

—— Head relatively small, length 9.8–11.4 in SL; posterior nasal pore present; back prominently hunchbacklike in all specimens; maximum SL 91 mm (WA) ..... *A. gibbosa* n.sp.

5 Gill slit moderately large, length 3.1–4.3 in head length; no postocular pores or nasal pores (Tas and WA) ..... *A. obtusirostris*

—— Gill slit small, length 5.4–22.9 in head length; postocular pores 1 or 2; nasal pores present or absent 6

6 Origin of dorsal fin just behind head; anal fin absent or restricted to region just anterior to caudal fin; interorbital very narrow, width 16.4–22.6 in head length; body orange in life (not translucent posteriorly), sides with alternating wide black and narrow white bars (NSW, Vic, and Tas) ..... *A. scotti* n.sp.

—— Origin of dorsal fin over region of urogenital opening or behind; anal fin prominent, extending about half way from caudal fin to anus; interorbital relatively wide, width 5.4–10.8 in head length; body translucent posteriorly in life, sides without alternating black and white bars 7

7 Postocular pores 2; posterior nasal pore usually present; caudal-fin rays 7–8 (NSW, Vic, Tas, SA, WA) ..... *A. hoesei*

—— Postocular pores 1; posterior nasal pore absent; caudal-fin rays fewer than 7 8

8 Origin of dorsal fin over region of urogenital opening; caudal-fin rays 4–6 9

—— Origin of dorsal fin well posterior to region of urogenital opening; caudal-fin rays absent (Norfolk Island) ..... *Alabes* sp.

9 Male with pattern of tiger-like bars on upper side of body in life, not merging ventrally with longitudinal series of four blackish to dark blue blotches on side of abdomen, blotches extending about half way to urogenital opening; lacrymal pores usually present (Qld, NSW, Tas) ..... *A. parvula*

—— Male with irregular arrangement of tiger-like stripes on head, merging ventrally with 2–3 blackish blotches that extend about one-third way to urogenital opening; lacrymal pores absent (WA) ..... *A. occidentalis* n.sp.

extremities (the measurement was not taken if the opening was torn). All cephalic sensory pores are very small but the postocular pore is usually the easiest to detect (see Springer & Fraser [1976: fig. 10] for the location of pores). Cleared and stained material was examined for vertebral counts; although much of the non-cleared and stained material was x-rayed, this proved unsatisfactory for making accurate counts in many of the smaller specimens. Table 1 lists the diagnostic characters for all the known species of *Alabes* (the following abbreviations are used in this table: POP—postocular pore; ANP—anterior nasal pore; PNP—posterior nasal pore; LP—lacrymal pores). The tables of meristics presented in the descriptive sections sometimes report only a selection of the available paratypes. These were selected to provide examples across the whole size range of the material. The counts and proportions appearing in parentheses represent the ranges for the paratypes where different from those of the holotype. The gender of *Alabes* is now considered to be feminine following Eschmeyer (1990). Institutional codes follow Leviton *et al.* (1985). Standard length is abbreviated SL, and head length is abbreviated HL.

Alabes Cloquet, 1816

Diagnosis (these characters are not repeated in the following descriptions): body elongate, eel-like, tapering to a small caudal fin; caudal fin with 4–12 fin rays, joined to dorsal and anal fins (latter two without fin-rays, resembling low folds of skin); pectoral fin absent; pelvic fin either represented by a small rudiment just posterior to gill opening, or absent; skin smooth, scaleless, usually covered with a thick mucus layer; lateral-line sensory system usually consists of small open cephalic pores and minute papillae (cephalic pores absent in one species); head small, with a short snout (rounded to pointed in dorsal view); nostrils small but obvious, anterior one tubular, posterior one with low raised rim; eye moderate in size, with prominent, clear cornea; gill opening a small to moderate-sized transverse slit, located on ventral surface of head; gills 3; branchiostegals 3; palatine and vomerine teeth absent; urogenital opening with prominent papilla.

Alabes elongata n.sp.

Fig. 2; Tables 1–2

Alabes dorsalis (*non* Richardson). Hutchins, 1994: 313 (in part).

Type material. HOLOTYPE: WAM P.28296-003, 86 mm SL, male, Western Australia, Recherche Archipelago, Mondrain Island, eastern side of island (34°08'S 122°15'E), rock and weed, rotenone at 5–6 m, J.B. Hutchins *et al.*, 13 April 1984. PARATYPES (5 specimens, 42–92 mm SL, from Western Australia): AMS I.42136-001, 80 mm SL, male, collected with holotype; WAM P.26004-012, 56 mm SL, Recherche Archipelago, Lucky Bay, unnamed island on eastern side of bay (34°00'S 122°14'E), rock and weed, rotenone at 14 m, J.B. Hutchins, 17 March 1978; WAM P.28280-002, 58 mm SL (cleared and stained), female, Israelite Bay, Dempster Point (33°37'S 123°53'E), seagrass bed, box trawl at 0.5–2.0 m, J.B. Hutchins, 1 April 1984; WAM P.28296-050, 92 mm SL, male, collected with holotype; WAM P.32205-001, 42 mm SL, Cervantes, NW of Outer Rocks (30°26'S 114°59'E), rocky reef, in sponge at 15 m, L.M. Marsh *et al.*, 4 May 1987.

Diagnosis. Diagnostic characters of *Alabes elongata* are listed in Table 1. It differs from all other species of *Alabes* by a combination of its elongate but robust body (depth 12.5–14.9 in SL), large gill slit (2.9–4.4 in HL), prominent rudimentary pelvic fin with obvious fin rays, single postocular pore on each side of head, and unique colour pattern. *Alabes elongata* is most similar to *A. dorsalis*, differing in its more elongate body (depth usually greater than 12 times in SL versus 11 or less) and different coloration (lacks the dark circular blotches on midside of body that characterize the adult male of *A. dorsalis*).

Description. Measurements of the holotype and paratypes are presented in Table 2. Maximum body depth 13.5 (12.5–14.9) and width at level of gill slit (= maximum body width) 13.9 (13.1–18.6), both in SL; head bluntly rounded anteriorly, somewhat compressed, slightly wider than body, head width 1.5 (1.4–1.8) in HL; HL 8.2 (7.9–9.1) in SL; snout short, rounded to truncate in dorsal view, length 4.4 (3.9–4.8) in HL; diameter of orbit 4.2 (4.3–5.6) in HL, slightly greater than bony interorbital width (5.1 [4.1–6.9] in HL); total of two lateral-line pores on each side of head, consisting of one postocular pore and one anterior nasal pore (indication of dorsal lacrymal pore visible in smallest paratype); gill opening a moderately wide slit, length 3.0 (2.9–4.4) in HL; mouth slightly inferior, upper lip projecting slightly forward of lower lip; rear corner of mouth below or slightly behind anterior margin of eye; teeth small, conical, caninelike, 1–2 rows in upper and lower jaws;

Table 2. Measurements (mm) and counts of the holotype and selected paratypes of *Alabes elongata* n.sp.

	holotype	paratypes			
	WAM P.28296-003	WAM P.28296-050	AMS I.42136-001	WAM P.26004-012	WAM P.32205-001
standard length	86	92	80	56	42
head length	11	12	9.7	6.2	5.0
snout length	2.4	2.6	2.2	1.3	1.3
eye diameter	2.5	2.2	1.8	1.5	0.9
interorbital width	2.0	2.8	2.0	1.0	0.7
gill-slit width	3.5	4.0	3.3	1.4	1.5
head width	7.2	8.2	6.7	3.5	3.1
body width at gill slit	6.2	7.0	6.0	3.0	2.7
body width (max.)	6.2	7.0	6.0	3.0	2.7
body depth (max.)	6.3	7.3	6.0	3.9	2.8
snout to dorsal fin	37	38	34	31	28
snout to anal fin	52	63	52	39	32
snout to anus	35	36	33	20	16
caudal-fin rays	7(8?)	9	8	8	6
postocular pores	1	1	1	1	1
post. nasal pores	0	0	0	0	0
ant. nasal pores	1	1	1	1?	1
dorsal lacrymal pores	0	0	0	0	1?
ventral lacrymal pores	0	0	0	0	0
sex	male	male	male	male?	female?

caudal fin with 7 (6–9) fin rays; bases of dorsal and anal fins long, insertion of dorsal fin slightly to well posterior to vertical through urogenital opening (snout to insertion 2.3 [1.5–2.4] in SL); insertion of anal fin about half way between urogenital opening and caudal fin (snout to insertion 1.7 [1.3–1.5] in SL); total vertebrae 75 (74–78), precaudal 22, last epineural on 28th vertebra.

Preserved coloration. Head and body overall pale creamy brown, fins more translucent.

Live coloration (based on colour transparencies of freshly collected holotype, see Fig. 2): ground colour pale creamy brown, with fine mottling of darker brown tending to form narrow, somewhat irregular cross bars on anterior portion of body, breaking up into a fine irregular reticulate pattern enclosing pale spots on posterior two-thirds (pattern extending onto fins); head with faint darker cross bars, red colour of gills visible through skin; paratypes range from similar to holotype to an overall pale brown or apple green without markings (smaller specimens).

Distribution. *Alabes elongata* is known only from southern Western Australia, from the Recherche Archipelago (including Israelite Bay) in the southeast to Cervantes on the mid-west coast.

Remarks. This species inhabits reef and weed areas from the intertidal to depths of 15 m. It has been found in both seagrass beds as well as on rocky reefs. It is apparently the sister species of *Alabes dorsalis* (both possess large gill openings and prominent pelvic-fin rudiments), the latter occurring in shallow intertidal areas of New South Wales, Victoria, Tasmania and South Australia. The two differ mainly in body depth and coloration of the adult male (see Diagnosis above). It is named *elongata* with reference to its elongate body.

Alabes gibbosa n.sp

Fig. 3; Tables 1, 3

Alabes brevis (*non* Springer & Fraser). Hutchins, 1991: 630, fig.

Type material. HOLOTYPE: WAM P.27985-001, 67 mm SL, male, Western Australia, Carnac Island, bay on eastern side (32°07'S 115°40'E), seagrass beds, box trawl at 3–4 m, J.B. Hutchins, 13 January 1982. PARATYPES (4 specimens, 71–91 mm SL, from Western Australia): WAM P.32206-001, 91 mm SL, female, Safety Bay, off yacht club towards Three Sisters (32°18.5'S 115°42.3'E), seagrass bed, beam trawl, P. Chalmer, 24 September 1981; WAM P.32207-001, 71 mm SL (cleared and stained), Carnac Island, bay on eastern side, seagrass, boxtrawl at 2 m, J.B. Hutchins and N.O. Sinclair, 10 February 1983; WAM P.32208-001, 87 mm SL, Rottnest Island, Porpoise Bay (32°01'S 115°32'E), seagrass, box trawl at 3–4 m, J.B. Hutchins and S. Morrison, 09 August 1996; WAM P.32209-001, 84 mm SL, Cockburn Sound, Success Bank (32°05'S 115°43'E), seagrass and sand, beam trawl, Murdoch University, 5 March 1997.

Diagnosis. The diagnostic characters of *Alabes gibbosa* are listed in Table 1. It differs from all other species of *Alabes* by a combination of its deep body (7.8–9.5 in SL), which usually exhibits a gibbous dorsal profile, relatively large gill slit (3.3–3.9 in HL), moderate-sized rudimentary pelvic fin without obvious pelvic spines or fin rays, two postocular pores, one post nasal pore above eye on each side of head, and a unique colour pattern. *Alabes gibbosa* is most similar to its apparent sister species, *A. brevis*, differing in its deeper and larger body (maximum size 91 mm SL versus 36 respectively), presence of a post nasal pore (usually absent in the latter species), more vertebrae (68–69 versus 61–62), and different coloration (males of *A. gibbosa* never develop a tigerlike pattern of irregular dark bars on the side of the head as found in *A. brevis*).

Description. Measurements of the holotype and paratypes are presented in Table 3. Body elongate and very compressed, dorsal profile rising abruptly over level of gill opening, reaching a maximum depth about midway between snout tip and caudal fin base, maximum body depth 7.8 (7.9–9.5) in SL, maximum body width 14.8 (11.6–22.6) and width at level of gill slit 19.1 (16.7–27.3), all in SL; head slightly rounded to somewhat pointed anteriorly, a little wider than body (head width 1.6 [1.5–2.1] in HL), HL 9.8 (9.8–11.4) in SL; snout triangular in dorsal view with rounded extremity, length 5.5 (4.0–5.3) in HL; diameter of orbit 4.2 (4.2–4.9) in HL, somewhat greater than bony interorbital width (5.5 [5.2–8.9] in HL); total of six cephalic pores on each side of head, consisting of two postocular pores widely separated, one posterior nasal pore, one anterior nasal pore and two lacrymal pores; gill opening a moderately narrow slit, length 3.9 (3.3–3.9) in HL; mouth slightly inferior, upper lip projecting slightly forwards of lower lip; rear corner of mouth below anterior margin of eye or slightly behind; teeth small, conical, somewhat caninelike, 1–2 rows in upper and lower jaws; caudal fin

Table 3. Measurements (mm) and counts of the holotype and selected paratypes of *Alabes gibbosa* n.sp.

	holotype	paratypes			
	WAM P.27985-001	WAM P.32206-001	WAM P.32208-001	WAM P.32209-001	WAM P.32207-001
standard length	67	91	87	84	71
head length	6.8	8.0	8.2	7.5	7.3
snout length	1.2	1.6	1.6	1.9	1.4
eye diameter	1.6	1.7	1.7	1.6	1.7
interorbital width	1.2	1.5	0.9	1.1	1.4
gill-slit width	1.8	2.4	2.2	1.9	2.0
head width	4.2	5.1	5.2	3.5	4.8
body width at gill slit	3.5	4.6	3.8	3.1	4.3
body width (max.)	4.5	7.1	3.8	3.8	6.1
body depth (max.)	8.5	10	9.2	11	8.8
snout to dorsal fin	26	28	39	31	29
snout to anal fin	28	33	40	36	35
snout to anus	21	33	28	26	23
caudal-fin rays	9	9	10	11	10
postocular pores	2	2	2	2	2
post. nasal pores	1	1	1	1	1
ant. nasal pores	1	1	1	1	1
dorsal lacrymal pores	1	1	1	1	1
ventral lacrymal pores	1	1	1	1	1
sex	male	female	male	male?	?

with 9 (9–11) fin rays; bases of dorsal and anal fins long, insertion of dorsal fin usually well posterior to vertical through urogenital opening (snout to insertion 2.5 [2.2–2.7] in SL), but in one paratype, origin of fin difficult to detect and appears to be over region of urogenital opening (3.25 in SL); insertion of anal fin a short distance posterior to urogenital opening (snout to insertion 2.4 [2.0–2.8] in SL); total vertebrae could not be counted for holotype but cleared and stained paratype has a total of 68 vertebra (19 precaudal), with last epineural on 20th vertebra (radiographs of two additional paratypes indicate counts of about 19+49–50 = 68–69).

Preserved coloration. Head and body overall pale brown, fins slightly more translucent (paratypes are similar in colour to holotype, but usually are a paler creamy brown with more translucent fins).

Live coloration (based on colour transparencies of a freshly collected specimen from Carnac Island [see Fig. 3], and live aquarium-maintained individuals)—ground colour apple green, somewhat translucent (internal organs slightly visible), with a sprinkling of dusky and pale spots on body, largest on midside of body following course of lateral-line (each lateral line papilla enclosed in a minute white spot, surrounded by a larger dusky spot) (see also colour plate in Hutchins, 1991); thin dark brown stripe continues from snout, through eye, to preopercular margin; snout and upper lip mostly brownish, lower lip whitish; in life, dusky spots may be very faint and white spots—especially those on rear portion of body—may be more silvery and considerably larger in size; body colour continued on to fins, with indications of faintly darker cross bars.

Distribution. *Alabes gibbosa* is known only from the Perth region of Western Australia, from Safety Bay to Rottnest Island.

Remarks. This species has only been collected from shallow coastal waters at depths between 2 and 4 m. It is similar to *Alabes brevis* (also endemic to southwestern Australia), from which it differs as described in the diagnosis above. Both occur in seagrass but *A. brevis* is also found in vegetation growing on shallow coastal rocky reefs.

Alabes obtusirostris n.sp

Fig. 1; Tables 1, 4

Type material. HOLOTYPE: CSIRO H.4462-01, 46 mm SL, Victoria, east of Lakes Entrance (between 37°52.8'S 148°11.8'E and 37°51.7'S 148°13.8'E), benthic sled at 28 m, FRV *Southern Surveyor*, 24 November 1996. PARATYPE: AMS I.37755-001, 21 mm SL, Western Australia, east of Binningup (33°09'S 114°49'E), depth 65 m, CSIRO, 10 August 1962 (field number G3/176/62).

Diagnosis. The diagnostic characters of *Alabes obtusirostris* are listed in Table 1. It differs from all other species of *Alabes* by a combination of its moderately large gill opening (3.1–4.3 in HL), lack of a pelvic-fin rudiment, absence of all cephalic pores in the lateral-line system, and its large number (40) of epineural ribs. It possesses a short, blunt head with wide lips (giving it a rather pugnacious appearance), and short dorsal and anal fins.

Description. Measurements of the holotype and paratypes are presented in Table 4. Body almost cylindrical, reaching a maximum depth about middle of body, then tapering posteriorly, body depth 13.6 (17.6) in SL, maximum body width (= width at level of gill slit) 14.3 (19.2) in SL; head rounded to somewhat blunt anteriorly, a little wider than body (head width 1.6 [1.9] in HL), HL 8.4(8.5) in SL; snout rather truncate in dorsal view, length 4.6 (4.1) in HL; diameter of orbit 4.8 (3.8) in HL, noticeably greater than bony interorbital width (6.9 [10.3] in HL); lateral-line sensory system lacking cephalic pores; gill opening a moderately narrow slit, length 3.1 (4.3) in HL; mouth terminal or lower jaw slightly projecting over upper jaw, upper and lower lips both fleshy and wide, producing a somewhat pugnacious appearance, rear corner of mouth reaching almost to below anterior margin of eye (pigmented area); teeth in holotype worn and more incisorform, those of paratype smaller, conical, caninelike, 1 row in upper and lower jaws; caudal fin with 8 fin rays; bases of dorsal and anal fins relatively short, insertion of dorsal fin well posterior to vertical through urogenital opening (snout to insertion 1.7 [2.0], snout to urogenital opening 2.5, both in SL); anal fin very short, insertion almost at caudal fin (snout to insertion 1.2 [1.1]in SL); total vertebrae could not be counted for holotype but cleared and stained paratype has a total of 70 vertebra (23 precaudal), with last epineural on 40th vertebra.

Preserved coloration (in alcohol). Head and body overall pale brown, fins more translucent; very faint indication of 3–5 reddish crossbands or blotches on body, more obvious on lower half of body.

Live coloration. Unknown but bands described above could have been blackish (see colour description of *A. scotti* n.sp. below).

Distribution. *Alabes obtusirostris* is known from only two locations: off Lakes Entrance in Victoria and off Binningup in southwestern Western Australia.

Remarks. This species has only been collected from coastal waters at depths between 28 and 65 m. Like *Alabes scotti* (described below), it appears to inhabit sandy bottoms. However, morphologically, it has more in common with *A. dorsalis* and *A. elongata* (described above); its body anteriorly is rather cylindrical in cross-section and it

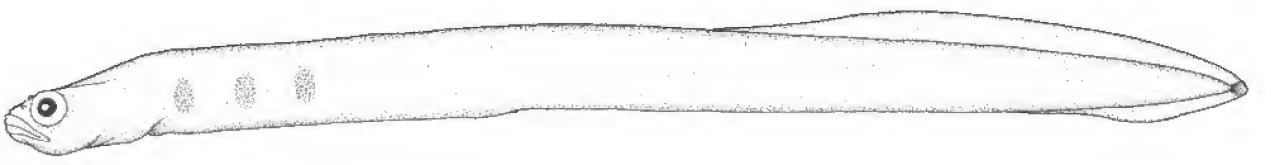

Fig. 1. *Alabes obtusirostris*. Holotype, CSIRO H.4462-01, 46 mm SL, Lakes Entrance, Victoria (drawn by S. Morrison).

possesses a large gill opening, but it lacks the prominent rudimentary pelvic fin that characterizes the latter two species. This species is named *obtusirostris* with reference to its blunt snout.

Table 4. Measurements (mm) and counts of the holotype and paratype of *Alabes obtusirostris* n.sp.

	holotype	paratype
	CSIRO H.4462-01	AMS I.37755-001
Standard length	46	21
Head length	5.5	2.5
Snout length	1.2	0.6
Eye diameter	1.1	0.6
Interorbital width	0.8	0.2
Gill-slit width	1.8	0.6
Head width	3.4	1.3
Body width at gill slit	3.2	1.1
Body width (max.)	3.2	1.1
Body depth (max.)	3.4	1.2
Snout to dorsal fin	27	11
Snout to anal fin	38	20
Snout to anus	19	8.8
Caudal-fin rays	8	8
Postocular pores	0	0
Post. nasal pores	0	0
Ant. nasal pores	0	0
Dorsal lacrymal pores	0	0
Ventral lacrymal pores	0	0

Alabes occidentalis n.sp.

Fig. 4; Tables 1, 5

Alabes parvulus (*non* McCulloch). Springer & Fraser, 1976: 19, fig. 12 (in part); Hutchins, 1991: 630, fig.; Hutchins, 1994: 314 (in part).

Type material. HOLOTYPE: WAM P.25465-001, 36 mm SL, male, Western Australia, Safety Bay, Seal Island (32°17.4'S 115°41.1'E), beam trawl in seagrass, J. Scott, 3 October 1975. PARATYPES (28 specimens, 17–40 mm SL, from Western Australia): AMS I.42137-001, 37 mm SL, male, collected with WAM P.28267-001 (see below); WAM P.25465-004, 3 specimens, 22–40 mm SL, collected with holotype; WAM P.25805-002, 26 mm SL, near Garden Island, just west of Five Fathom Bank (32°17'S 115°31'E), trawled at 37 m, N. Sarti and R. George, 29 June 1977; WAM P.27952-012, 5 specimens, 17–31 mm SL, Jurien Bay, south side of Boullanger Island (30°18'S 115°00'E), seagrass bed, box trawl at 1 m, J.B. Hutchins *et al.*, 11 April 1983; WAM P.28267-001, 5 specimens, 34–38 mm SL, Carnac Island, east of island (32°07'S 115°40'E), seagrass, box trawl at 3–4 m, J.B. Hutchins *et al.*, 10 February 1984; WAM P.28280-001, 6 specimens, 27–35 mm SL (2 cleared and stained), Israelite Bay, near Point Dempster (33°37'S 123°53'E), seagrass, box trawl at 0.5–2.0 m, J.B. Hutchins, 1 April 1984; WAM P.28291-001, 3 specimens, 27–30 mm SL, Great Australian Bight, Twilight Cove, just off beach (32°16'S 126°02'E), seagrass, box trawl at 0.2–1 m, J.B. Hutchins, 10 April 1984; WAM P.30384-002, 4 specimens, 29–39 mm SL, Rottnest Island, Porpoise Bay (32°01'S 115°32'E), seagrass, box trawl at 2–4 m, J.B. Hutchins, 21 November 1991.

Diagnosis. The diagnostic characters of *Alabes occidentalis* are listed in Table 1. It differs from all other species of *Alabes* by a combination of its elongate transparent body (depth 9.1–15.9 in SL), very small gill slit (5.4–17.5 in HL), no rudimentary pelvic fin, single postocular pore, anterior nasal pore present but posterior nasal pore absent, no lacrymal pores and unique colour pattern in adult male (tiger-like brownish orange bars anteriorly on side of body, darker ventrally). *Alabes occidentalis* is very similar to *A. parvula*, differing in the shape of the posterior portion of the gut (shorter and more rounded in *A. parvula* when viewed laterally in freshly caught material), lack of lacrymal pores (usually present in *A. parvula*) and in coloration of the adult male (see Remarks below).

Description. Measurements of the holotype and paratypes are presented in Table 5. Body elongate, more subcylindrical in adult male, maximum body depth 9.1 (9.9–15.9), maximum body width 16.7 (15.5–22.4) and body width at level of gill slit 16.7 (15.5–20.5), all in SL; head pointed, compressed, length 8.3 (7.8–10.0) in SL; snout rounded to slightly truncate in dorsal view, length 3.6 (3.1–4.0) in HL; diameter of orbit 3.5 (3.0–4.1) in HL, prominently larger than bony interorbital width (5.6 [6.5–10.4] in HL); total of two cephalic pores on each side of head, consisting of one postocular pore, one anterior nasal pore (no clearly defined lacrymal pores could be found); gill opening a short, narrow slit, width 8.2 (5.4–17.5) in HL; mouth inferior, upper lip projecting slightly forward of lower lip; rear corner of mouth below anterior margin of eye or slightly behind; teeth small but caninelike, 1–2 rows in upper and lower jaws; caudal fin apparently deformed in holotype, with only 1 or 2 rays (paratypes with 4–6 fin rays), continuous with dorsal and anal fins; bases of dorsal and anal fins long, insertion of dorsal fin over or slightly behind vertical through urogenital opening, snout to insertion 2.6 [2.7–3.1] in SL; insertion of anal fin about half way between urogenital opening and caudal fin (snout to insertion 1.7 [1.6–1.8] in SL); total vertebrae 63–69, precaudal 15–17, last epineural on 16–17th vertebra.

Preserved coloration (in alcohol). Head and body pale brown overall, fins more translucent (see also Remarks below).

Live coloration (based on colour transparencies of freshly collected material, Fig. 4): male—body mostly translucent to transparent, with organs visible through skin, although abdominal portion becoming more milky coloured anteriorly with a tiger-like pattern of brownish orange bars, distinctly darker ventrally, bars extending less than half distance to urogenital opening (see Springer & Fraser, 1976: fig. 12d,e [as *Alabes parvulus*]); head brown, consisting of dark brown blotches below and behind eye; silvery white spot at rear of body (not always visible); dorsal fin with dusky blotches along length, fading posteriorly (usually no

Table 5. Measurements (mm) and counts of the holotype and selected paratypes of *Alabes occidentalis* n.sp.

	holotype	paratypes							
	WAM P.25465-001	WAM P.25465-004	WAM P.28267-001	WAM P.28280-001	WAM P.28267-001	WAM P.27952-012	WAM P.28280-001	WAM P.28291-001	WAM P.25805-002
standard length (SL)	36	40	38	35	34	31	27	27	26
head length	4.3	4.2	4.0	3.6	3.9	3.9	3.2	3.4	3.1
snout length	1.2	1.2	1.2	1.0	1.1	1.1	0.9	0.8	1.1
eye diameter	1.2	1.2	1.2	1.2	1.2	1.2	1.0	1.1	0.8
interorbital width	0.8	0.6	0.4	0.5	0.4	0.4	0.4	0.4	0.3
gill slit width	0.5	0.4	0.5	0.7	0.4	0.4	0.4	0.2	0.3
head width	2.6	2.3	2.2	1.9	2.1	1.9	1.6	1.7	1.5
body width at gill slit	2.1	2.0	2.0	1.7	2.0	1.7	1.3	1.4	1.3
body width (max.)	2.1	2.2	2.2	1.7	2.0	1.7	1.3	1.4	1.3
body depth (max.)	3.9	4.1	3.2	3.2	3.0	3.0	2.2	2.4	1.6
snout to dorsal fin	14	14	14	11	12	11	10	10	9
snout to anal fin	21	24	22	22	20	19	16	17	14
snout to anus	11	13	12	11	10	10	8.8	8.8	8.5
caudal fin rays	1(2?)*	6	6	6	6	5	5	5	6
postocular pores	1	1	1	1	1	1	1	1	1
post. nasal pores	0	0	0	0	0	0	0	0	0
ant. nasal pores	1	1	1	1	1	?	1	1	1
dorsal lacrymal pores	0	0	0	0	0	0	0	0	0
ventral lacrymal pores	0	0	0	0	0	0	0	0	0
sex	male	female	male	female	female	male	female	female	female

* Count affected by deformity

dusky bars on dorsal surface of back); female—body transparent, with all organs visible through skin (see Hutchins, 1991: 631 [as *Alabes parvulus*]); no tiger-like pattern of bars anteriorly although numerous short, dark-brown bars present across ventral and dorsal surfaces of abdomen (see Springer & Fraser, 1976: fig. 12a–c); head mostly transparent with several short, dark bars and spots below eye; dusky blotches on dorsal fin and silvery white spot on rear of body as in male.

Distribution. *Alabes occidentalis* ranges from the Houtman Abrolhos in Western Australia to Twilight Cove in the Great Australian Bight. Specimens from South Australia and Tasmania identified as *Alabes parvula* may also prove to be this species, but freshly caught material has not yet been examined.

Remarks. *Alabes occidentalis*, unlike its apparent close relative, *A. parvula*, has only been taken from seagrass beds (the latter has also been found in reef and algal areas, particularly intertidal rock pools). The two species are so similar that they were initially treated by Springer & Fraser (1976) as belonging to one species, *A. parvula*. The figures of that species (Springer & Fraser, 1976: fig. 12) were based wholly on Western Australian material, and are thus illustrative of *A. occidentalis* and not *A. parvula*. Although the female colour pattern of both species is similar, that of the male differs considerably between species. The male of *A. parvula*, in comparison to the colour description of *A. occidentalis* provided above, is distinguished by the following: anterior portion of body with a tiger-like pattern of irregular reddish-brown bars, bars continued onto head and break into spots, and also continue posteriorly, and break into spots; abdominal area bright orange to yellow with four large bluish black circular to rectangular blotches, arranged in a horizontal line along lower side, extending over half distance to urogenital opening. Other differences are described in the Diagnosis above. *Alabes hoesei* is also very similar to *A. occidentalis* but is easily distinguished by the higher number of cephalic sensory pores (Table 1). This species is named *occidentalis* because of its western distribution.

Alabes scotti n.sp.

Fig. 5; Tables 1, 6

Type material. HOLOTYPE: CSIRO H.3776-01, 48 mm SL, New South Wales, Disaster Bay (from 37°18.9'S 149°59.6'E to 37°16.5'S 149°59.3'E), benthic sled at 24–30 m, G. Yearsley on FRV *Southern Surveyor*, 2 September 1994. PARATYPES (7 specimens, 28–48 mm SL, from southeastern Australia): AMS I.23428-001, 3 specimens: 40–45 mm SL (smallest cleared and stained), Tasmania, off Wardley's Point (41°40'S 148°18'E), depth 27 m, P. Colman on RV *Sprightly*, 24 May 1973 (BMR station 573–2032); AMS I.36095-001, 28 mm SL, Tasmania, south of St Helens Point (41°30'S 148°17.5'E), benthic grab at 31 m (over very coarse yellowish sand), P. Colman on RV *Sprightly*, 24 March 1973 (BMR station S73–2033); AMS I.37680-001, 2 specimens, 39–41 mm SL, New South Wales, off Tathra (from 36°37'S 150°02'E to 36°40'S 150°04'E), bottom trawl at 38–46 m, FRV *Kapala*, 13 December 1994 (field number 94-33-04); WAM P.32222-001, 43 mm SL (cleared and stained), collected with AMS I.37680-001.

Diagnosis. The diagnostic characters of *Alabes scotti* are listed in Table 1. It differs from all other species of *Alabes* by a combination of its thin, elongate body, slender, acute head with relatively long, projecting upper lip, very small gill opening, 4–5 caudal-fin rays, long but very low dorsal fin, almost non-existent anal fin, and unique black and white barred coloration. *Alabes scotti* is similar to both *A. parvula* and *A. occidentalis* (described above), differing in coloration, its apparent lack of transparency of the body, and different vertebral features (see Table 1).

Description. Measurements of the holotype and paratypes are presented in Table 6. Body very elongate and subcylindrical, reaching a maximum depth about middle of body, then tapering to a very small caudal fin, body depth 15.8 (16.1–18.7) in SL, width at level of gill slit (= maximum body width) 23.3 (20.7–28.2) in SL; head acute, a little wider than body (head width 2.9 [2.6–3.0] in HL), HL 6.6 (6.2–7.2) in SL; snout triangular in dorsal view, with a pointed fleshy upper lip, length 5.4 (4.8–6.3) in HL; diameter of orbit 5.6 (5.3–5.9) in HL; bony interorbital very narrow, width (17.9 [16.4–22.6] in HL); total of two cephalic pores on each side of head, consisting of one postocular pore and one anterior nasal pore (latter very small and in some paratypes, difficult to detect). Gill opening very small, length 16.3 (13.6–23.0) in HL; mouth inferior, upper lip projecting well forward of lower lip (both lips fleshy), rear corner of mouth reaching almost to below anterior margin of eye (pigmented area); teeth conical, caninelike, 1 row in upper and lower jaws; margin of dorsal fin in holotype rather irregular in outline; caudal fin with 4 (4–5) fin rays; base of dorsal fin long, insertion just behind rear border of head (snout to insertion 5.2 [4.2–5.5] in SL); anal fin very short, lower than dorsal fin in height, insertion just anterior to caudal fin (snout to insertion 1.1 [1.0–1.3] in SL), continuing anteriorly as a low skin ridge; snout to urogenital opening 2.6 (2.5–2.7) in SL; urogenital papilla considerably enlarged in holotype; total vertebrae could not be counted for holotype but cleared and stained paratype has a total of 68 vertebra (22 precaudal), with last epineural on 26th vertebra.

Preserved coloration (in alcohol). Head and body overall pale brown, fins more translucent; 5 faint reddish crossbands on body, anteriormost at level of gill opening, posterior 4 continuing onto dorsal fin (urogenital opening located midway between bars 3 and 4).

Live coloration (based on a colour transparency of the holotype taken just after capture, Fig. 5): ground colour brownish orange, tail a little paler posteriorly; 5 blackish cross bars outlined with white on anterior portion of body, posterior two more brownish, although dorsal edge blackish; five white transverse lines interspersed between black bars, one between each pair of black bars and one anterior to first bar.

Distribution. *Alabes scotti* is known only from a few scattered coastal localities off southeastern Australia, from Tathra in southern New South Wales, west to Cape Everard in eastern Victoria, and south to the region of St Helens Point in northeastern Tasmania.

Remarks. *Alabes scotti* apparently lives on sandy bottoms at depths between 24 and 46 m from which it has been collected using benthic sleds and grabs. It occupies a similar habitat to that of *Alabes obtusirostris* (described above), and may be easily separated from the latter by its more acute head (latter has a blunt head). The late E.O.G Scott of Launceston, Tasmania, first brought this species to the senior author's attention in 1982 when he provided a rough illustration of a clingfish he believed was undescribed. Unfortunately he never pursued his plan to describe it and his specimens have not been located (R. Green, pers. comm.) This species, therefore, is named *scotti* in his honour.

Table 6. Measurements (mm) and counts of the holotype and selected paratypes of *Alabes scotti* n.sp.

	holotype	paratypes					
	CSIRO H.3776-01	AMS I.23428-001	AMS I.23428-001	WAM P.32222-001	AMS I.37680-001	AMS I.37680-001	AMS I.36095-001
standard length (SL)	48	45	43	43	41	39	28
head length	7.2	6.3	6.3	6.3	5.9	6.0	4.6
snout length	1.3	1.1	1.2	1.3	1.2	1.2	0.8
eye diameter	1.3	1.1	1.1	1.2	1.0	1.1	0.8
interorbital width	0.4	0.3	0.3	0.3	0.3	0.3	0.3
gill slit width	0.4	0.4	0.5	0.3	0.3	0.3	0.2
head width	2.5	2.3	2.4	2.2	2.0	2.1	1.6
body width at gill slit	2.0	1.8	1.8	1.7	1.6	1.7	1.0
body width (max.)	2.0	1.8	1.8	1.7	1.6	1.7	1.0
body depth (max.)	3.0	2.6	2.3	2.6	2.3	2.4	1.7
snout to dorsal fin	9.0	8.3	8.0	9.8	7.7	7.2	6.3
snout to anal fin	43	40	39	41	39	36	26
snout to anus	18	17	16	16	15	15	11
caudal fin rays	4	4	5	4	5	4	5
postocular pores	1	1	1	1	1	1	1
post. nasal pores	0	0	0	0	0	0	0
ant. nasal pores	1	1	1	1	?	?	1
dorsal lacrymal pores	0	0	0	0	0	0	0
ventral lacrymal pores	0	0	0	0	0	0	0
sex	?	?	?	?	?	?	?

Fig. 2. *Alabes elongata*. Holotype, male, WAM P.28296-003, 86 mm SL, Recherche Archipelago, Western Australia.

Fig. 3. *Alabes gibbosa*, paratype, WAM P.32202-001, 71 mm SL, Carnac Island, Western Australia; (*a*) whole specimen, (*b*) anterior half of specimen.

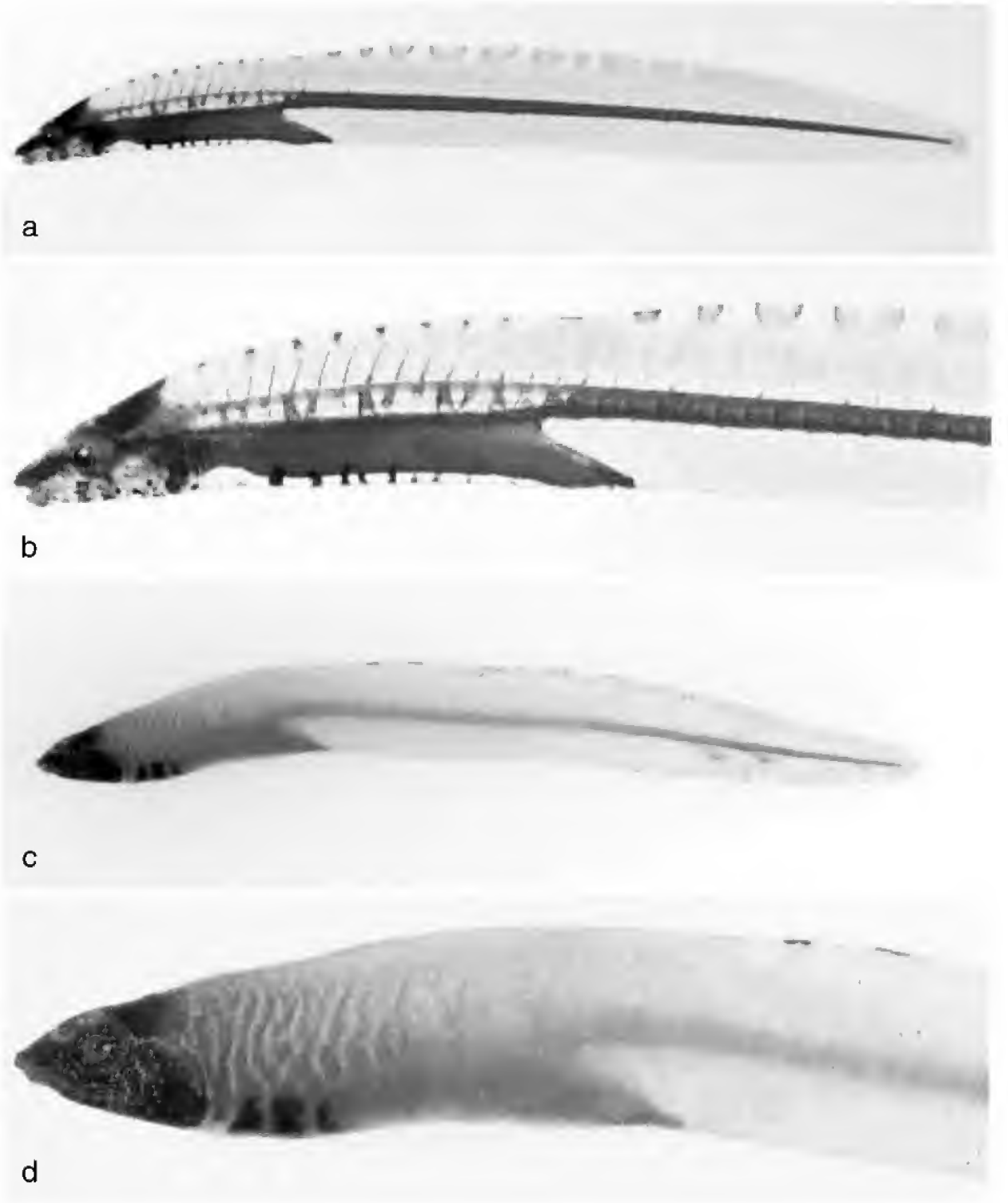

Fig. 4. *Alabes occidentalis* paratype, female, WAM P.28280-001, 35 mm SL, Israelite Bay, Western Australia: (*a*) whole specimen; (*b*) anterior half of specimen. Paratype, male, WAM P.30384-002, 38 mm SL, Rottnest Island, Western Australia: (*c*) whole specimen; (*d*) anterior half of specimen.

Fig. 5. *Alabes scotti*. Holotype, CSIRO H.3776-01, 48 mm SL, Disaster Bay, New South Wales (CSIRO photograph).

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A New Species of the Anglerfish Genus *Lophiocharon* Whitley (Lophiiformes: Antennariidae) from Australian Waters

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ABSTRACT. A new species of the antennariid anglerfish genus *Lophiocharon, L. hutchinsi*, is described on the basis of nine specimens collected from Western Australia, Northern Territory, and Queensland, and from the Aru Islands, Indonesia. It differs from its congeners in having a combination of features that includes a reduced esca, scarcely, if at all, differentiated from the illicium, and a relatively short illicium covered from base to tip with small dermal spinules.

PIETSCH, THEODORE W., 2004. A new species of the anglerfish genus *Lophiocharon* Whitley (Lophiiformes: Antennariidae) from Australian waters. *Records of the Australian Museum* 56(2): 159–162.

Within the material of the anglerfish genus *Lophiocharon* Whitley, examined by Pietsch & Grobecker (1987) in their revision of the anglerfish family Antennariidae, are five specimens that do not conform to the diagnosis of either of the two recognized species of the genus, *Lophiocharon trisignatus* (Richardson, 1844) and *Lophiocharon lithinostomus* (Jordan & Richardson, 1908). Uncomfortable at the time about describing a new species based on only a few small individuals, the material was labelled *Lophiocharon* sp. and set aside pending additional specimens (Pietsch & Grobecker, 1987: 231). As in *L. lithinostomus*, the illicium of these unidentified specimens is covered with dermal spinules and the esca is very much reduced or absent, yet the length of the illicium is considerably less than that of both *L. lithinostomus* and *L. trisignatus*. The recent discovery of four additional specimens that compare very well to the original five prompted the following description.

Materials and methods

Standard lengths (SL) are used throughout. Terminology used to describe the parts of the angling apparatus follows Bradbury (1967). Illicium length is measured from the point of articulation of the pterygiophore of the illicium and the illicial bone to the distal surface of the esca excluding escal appendages or filaments. All other methods follow those used by Pietsch & Grobecker (1987). Material is deposited in the Australian Museum, Sydney (AMS), the Western Australian Museum, Perth (WAM), and the Zoological Museum, University of Amsterdam (ZMA).

Genus *Lophiocharon* Whitley, 1933

Lophiocharon Whitley, 1933: 104 [type species *Lophiocharon broomensis* Whitley, 1933 (a junior synonym of *Cheironectes trisignatus* Richardson, 1844), by original designation and monotypy].

Plumantennatus Schultz, 1957: 89 [type species *Antennarius asper* Macleay, 1881 (a junior synonym of *Cheironectes trisignatus* Richardson, 1844), by original designation and monotypy].

Diagnosis. *Lophiocharon* is unique among antennariid genera in having the illicial bone and second dorsal spine widely separated, the distance between the bases of these elements about 50% of the length of the pterygiophore of the illicium (less than about 35% of pterygiophore length in all other antennariids). This genus differs further from all other antennariid genera in having a row of 2–4 regularly spaced, more or less translucent (transparent in some specimens) ocelli on the membrane between each two rays of the caudal fin (best observed with the caudal rays spread; see Pietsch & Grobecker, 1987: 225, 227; figs. 92, 93; colour pl. 42) and in having the anterior tip of the pterygiophore of the illicium distinctly upturned.

Lophiocharon is further distinguished from all other antennariids by having the following combination of character states: skin covered with close-set bifurcate dermal spinules, the length of spines of each spinule not more than twice the distance between tips of spines (Pietsch & Grobecker, 1987: 33, fig. 16G); illicium naked (*L. trisignatus*) or covered throughout its length with dermal spinules (*L. lithinostomus* and *L. hutchinsi*); esca large and complex (*L. trisignatus*) or greatly reduced or absent (*L. lithinostomus* and *L. hutchinsi*); pectoral lobe broadly attached to side of body; caudal peduncle absent, the membranous posteriormost margin of soft-dorsal and anal fins attached to body at base of outermost rays of caudal fin; all rays of caudal fin bifurcate; mesopterygoid absent; pharyngobranchial I absent; epural absent; swimbladder present; dorsal rays 12 or 13; anal rays 6–8; pectoral rays 8 or 9 (Pietsch & Grobecker, 1987: 30, 34, 222; tables 1, 2, 11).

Description. See Pietsch & Grobecker, 1987: 222–223.

Three species, all restricted to the Indo-Australian Archipelago:

Key to known species of the genus *Lophiocharon*

1 Illicium naked, not covered with dermal spinules; esca large, morphologically complex ..... *Lophiocharon trisignatus* (Richardson, 1844)

Ninety-four specimens examined, 8–147 mm SL, Indo-Australian Archipelago.

—— Illicium covered from base to tip with dermal spinules; esca reduced, scarcely if at all differentiated from illicium 2

2 Illicium long, 21.6–36.4% SL (Fig. 1) .... *Lophiocharon lithinostomus* (Jordan & Richardson, 1908)

Fifteen specimens examined, 54–91 mm SL, North Borneo, Sulu Archipelago to Philippines.

—— Illicium short, 9.6–12.9% SL (Fig. 1)..... *Lophiocharon hutchinsi* n.sp.

Nine known specimens, 14–49 mm SL, northern Australia and Aru Islands.

Lophiocharon hutchinsi n.sp.

Figs. 1–2, Plate 1

Antennarius caudimaculatus (*non* Rüppell). Weber, 1913: 562 (misidentification, ZMA 116.513, Aru Islands).

Lophiocharon sp.—Pietsch & Grobecker, 1987: 224, 231; fig. 91 (five specimens, probably representing an undescribed species).

Type material. HOLOTYPE: WAM P.27673-002, 43 mm, James Price Point, 55 km north of Broome, Western Australia, 17°26'S 122°10'E, rotenone, 31 July 1982. PARATYPES: AMS I.15557-283, 2 (47–49 mm), Gulf of Carpentaria, Queensland, 17°00'S 140°16'E; WAM P.24486, 33 mm, Exmouth Gulf, Western Australia, July 1973; AMS I.34780-001, 14 mm, Lee Point, Darwin Country, Northern Territory, 12°20'S 130°53'E, SCUBA, 3.0 m, 11 July 1993; WAM P.31884-001, 31 mm, south of Bluff Point, Enderby Island, Dampier Archipelago, Western Australia, 20°40.9'S 116°33.2'E, box dredge on sandy mud, sponge, and seagrass, 9.0–9.2 m, 23 July 1999; WAM P.28416-015, 2 (19–29 mm), Gantheaume Point, Broome, Western Australia, 17°58'S 122°10'E, rotenone, 2–5 m, 13 September 1982; ZMA 116.513, 18 mm, anchorage off Jedan Island, Aru Islands, Indonesia, Weber, 1899.

Diagnosis. A member of the genus *Lophiocharon*, as recognized by Pietsch & Grobecker (1987), unique among its congeners in having a combination of character states that includes a reduced esca (scarcely, if at all differentiated from the illicium) and a relatively short illicium (Fig. 1), covered from base to tip with small dermal spinules (Plate 1).

Description. Illicium with a single tiny distal filament; length of illicium 9.6–12.9% SL; length of second dorsal-fin spine 14.4–15.8% SL; length of third dorsal-fin spine 19.7–23.4% SL; distance between bases of illicium and second dorsal-fin spine 6.5–7.6% SL; diameter of eye 5.2–7.7% SL; dorsal rays 13; anal rays 7; pectoral rays 9.

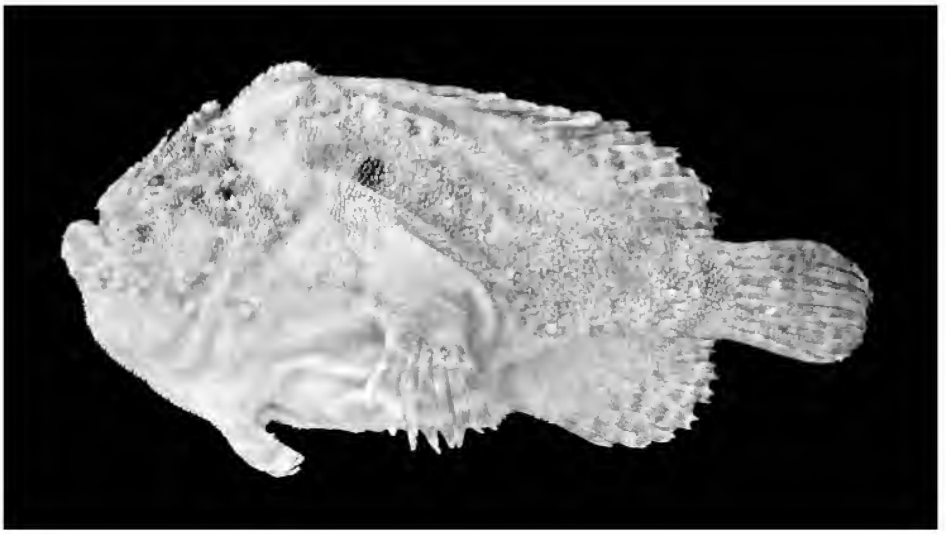

Plate 1. *Lophiocharon hutchinsi* n.sp., holotype, WAM P.27673-002, 43 mm, James Price Point, 55 km north of Broome, Western Australia, 17°26'S 122°10'E, rotenone, 31 July 1982.

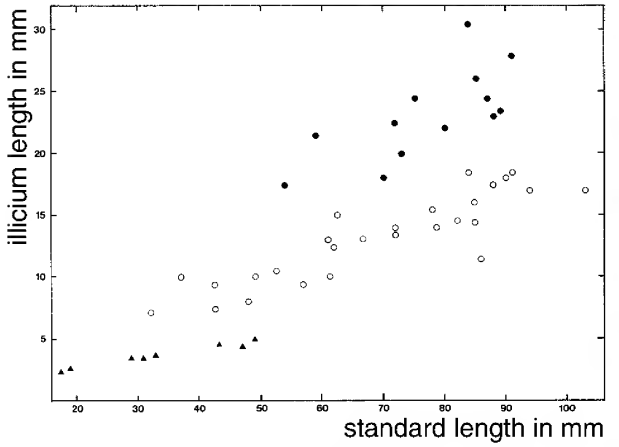

Fig. 1. Relationship between illicial length and standard length for species of *Lophiocharon*: *L. hutchinsi* n.sp. (▲), *L. trisignatus* (Richardson, 1844) (○), and *L. lithinostomus* (Jordan & Richardson, 1908) (●).

All known specimens in light-colour phase: cream, beige, light yellow-brown to brown overall; dorsal and lateral surfaces, including fins, everywhere covered with speckles and mottling of darker brown, especially dense on face around eye; basidorsal spot and light-coloured bar across base of caudal fin absent; illicium without banding; one or two dark circular spots on side of body above and/or slightly behind base of pectoral-fin lobe (similar to those found in other species of the genus, e.g., *L. trisignatus*; see Pietsch & Grobecker, 1987: 225, fig. 92); dark streak sometimes radiating out from eye; caudal ocelli faint, discernible only in largest known specimens (Plate 1).

Additional description as given for the genus.

Etymology. Named for Barry Hutchins, Curator of Fishes, Western Australian Museum, Perth, for providing most of the material on which this new species is based, and for his many contributions to Australian ichthyology.

Distribution. All nine known specimens of *L. hutchinsi* were taken in northern Australian and southern New Guinean waters: five specimens from Western Australia, at Exmouth Gulf, the Dampier Archipelago, and Broome; one from Northern Territory, at Lee Point, near Darwin; two from Queensland in the Gulf of Carpentaria; and one from the Aru Islands in the Arafura Sea.

Comments. *Lophiocharon hutchinsi* is clearly distinguished from *L. trisignatus* in lacking a distinct esca and in having a shorter, spiny illicium (see Fig. 1). On the other hand, the only feature that separates it from *L. lithinostomus* is its considerably shorter illicium (9.6–12.9% SL vs. 21.6–36.4% SL). Because all nine known specimens of *L. hutchinsi* are small (less than 50 mm SL) and all known individuals of *L. lithinostomus* are relatively large (54–91 mm SL), it might be argued that *L. hutchinsi* simply represents juvenile specimens of the latter. However, if this were true it would necessitate an extremely rapid ontogenetic increase in illicial length, the evidence for which is lacking in all other lophiiform fishes for which adequate material has been studied. It should be pointed out also that as presently understood *L. lithinostomus* and *L. hutchinsi* are allopatric: the former ranges from North Borneo to the Sulu Archipelago and the Philippines, whereas the latter is known only from northern Australia and the Aru Islands (Fig. 2). The third known species of *Lophiocharon, L. trisignatus*, is sympatric with both its congeners, ranging from tropical Australia to the Philippines.

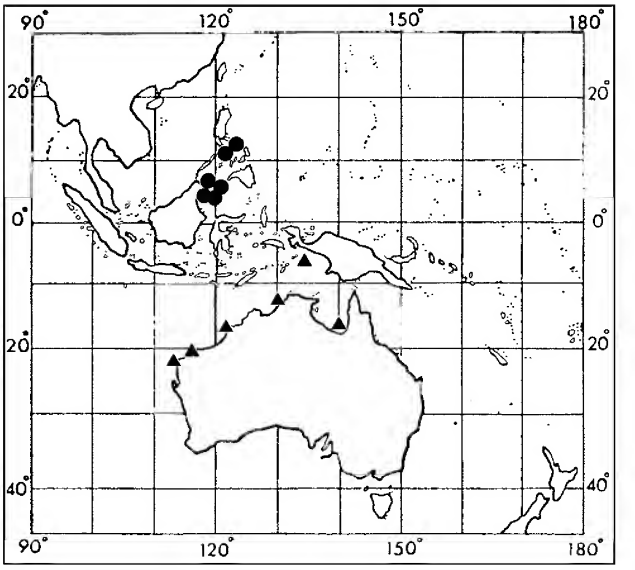

Fig. 2. Known distribution of *Lophiocharon hutchinsi* n.sp. (▲), northern Australia and Aru Islands; and *L. lithinostomus* (Jordan & Richardson, 1908), North Borneo, Sulu Archipelago, and the Philippines (●). A single symbol may indicate more than one capture.

ACKNOWLEDGMENTS. I thank Jeff Leis (AMS) and Martin Gomon (Museum Victoria, Melbourne) for inviting me to take part in this project, and Mark McGrouther (AMS) and Barry Hutchins and Sue Morrison (WAM) for providing specimens and locality data.

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A New Pygmy Pipehorse (Pisces: Syngnathidae: *Idiotropiscis*) from Eastern Australia

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ABSTRACT. A new species of pygmy pipehorse, *Idiotropiscis lumnitzeri*, is described from a female and two male specimens collected in the Sydney region, New South Wales, Australia. It can be distinguished from its congeners, *I. australe* (Waite & Hale, 1921) and *I. larsonae* (Dawson, 1984), in having a shorter and more posteriorly positioned frontal ridge dorsally on the head, a very short trunk (slightly longer than head, versus clearly longer than head), and in having a longer snout (2.2–2.6 in head, versus 2.8–3.2 in *I. australe* and 3.7–3.8 in *I. larsonae*).

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I became aware of this species in the early 1990's when sent an image of a pipehorse by a photographer from Sydney for identification. The subject of the photograph, taken in Jervis Bay, south of Sydney, was thought by the photographer to be a juvenile seahorse. I tentatively identified it as *Acentronura tentaculata*. The first specimen collected in 1997 was immediately recognized as representing a new species of *Idiotropiscis* Whitley, 1947, a genus that is very similar to *Acentronura* Kaup, 1853 and treated by some authors as a subgenus of it (e.g., Dawson, 1985). Species of *Idiotropiscis*, however, are more seahorse-like than those of *Acentronura*, in having a deeper body and head that is clearly angled ventrad from the longitudinal axis of the body, and in having discontinuous superior trunk and tail-ridges. Kuiter (2000) recognized *Idiotropiscis* at the generic level. The specimen collected in 1997 and two more specimens collected in 2002 provide the basis for this description.

Materials and methods

Methodology follows Kuiter (2001), except total length (TL), measured from tip of snout to end of tail, is used as a measure of overall length. Specimens were placed in a purpose-built, tray-like aquarium and photographed with a 35 mm single-reflex camera and 105 mm macro lens. Specimens were laid on their side on the bottom of the aquarium and flattened under a sheet of glass to ensure an accurate lateral image. Proportional measurements were recorded from enlargements. Radiographs were used to determine and confirm the number of trunk and tail rings. Sex was inferred from the absence or presence of a brood pouch. Types are deposited in the collection of the Australian Museum, Sydney (AMS) and Museum Victoria (NMV).

Idiotropiscis lumnitzeri n.sp.

Sydney's Pygmy Pipehorse

Figs. 1, 2

Idiotropiscis sp 1.—Kuiter, 2000, 66–67.

Type material. HOLOTYPE: AMS I.38660-001, 55.2 mm TL, male, Henrietta Head, La Perouse, Sydney, New South Wales (34°00'S 151°15'E), 22 m, Á. Lumnitzer, 26 Oct 1997. PARATYPES: AMS I.41409-001, 35.5 mm TL, male, Oak Park, Cronulla, New South Wales (34°03'S 151°09'E), 9 m, Á. Lumnitzer, 28 Jun 2002; NMV A24724, 35.0 mm TL, female, Oak Park, Cronulla, New South Wales, 9 m, Á. Lumnitzer, 28 Jun 2002.

Diagnosis. Superior trunk and tail ridges discontinuous; rings 11 + 43–44; dorsal-fin rays 15–16; pectoral-fin rays 13; subdorsal rings 2.5 + 1.5; head length 86–91% of trunk length, and angled ventrad approximately 25° from longitudinal axis of body; trunk length 18–20% TL; snout length 2.2–2.6 in head length; top of head with prominent, tall, frontal ridge.

Description. Head large, 86% (89–91%) of trunk length, and angled ventrad approximately 25° from longitudinal axis of body; snout short, length 28% (27–31%) of head length, depth 46% (45–47%) of its length; trunk very deep, its greatest depth 73% of its length (holotype brooding, 45–51% in non-brooding paratypes), narrowest at third and fourth ring where curving and forming angle of head from longitudinal axis of body, giving neck-like appearance as in seahorses, but less pronounced; rings 11 + 43 (43–44); superior trunk-ridge ending below dorsal-fin base, above origin of superior tail-ridge, ridges overlapping over one ring; brood pouch spanning 10 tail rings; subdorsal rings 2.5 + 1.5; dorsal-fin rays 15 (15–16), fin base arched dorsally at centre, pectoral-fin rays 13.

Top of head with prominent, tall, frontal ridge, originating well behind eye, with thick, long, branched, fleshy dermal appendage, reaching forward to above tip of snout. Numerous simple to fern-like branched, fleshy dermal appendages on head and body, best developed above eye, under snout and at various intersections of rings and superior ridges on trunk and tail, manifested as 6 or 7 symmetrical pairs from about centre of trunk to about 20th tail ring, pairs separated by about 5 rings and becoming gradually smaller posteriorly.

Live coloration (based in part on photographs in Kuiter, 2000: 66 & 67, figs. A–L): white to dark grey with brown to red blotches or irregular banding; sometimes uniformly burgundy-red. Fleshy appendages mostly red with grey branches or tips.

Preserved coloration (in alcohol). Uniformly dark brown.

Etymology. This species is named after Á. Lumnitzer, who collected the type specimens.

Distribution and ecology. This species is primarily known from photographs taken in the Sydney region (Clovelly, Cronulla and Botany Bay), and Jervis Bay. It is reported to occur in depths of 6–30 m, over semi-exposed rocky reefs, sparsely covered with bushy red-algae in which the species is extremely well camouflaged (Fig. 2). According to M. Brooke (pers. comm.), who monitored populations over an eight-year period, individuals live on the same small sections of reef for long periods, with some seen regularly for up to about 8 months.

Remarks. *Idiotropiscis lumnitzeri* is geographically separated from its congeners. *Idiotropiscis australe* occurs in South Australia and the southern region of Western Australia, and *I. larsonae*, is only known from the Monte Bello Islands, Western Australia. *Idiotropiscis lumnitzeri* is readily distinguished from *I. australe* in having 11, versus 12 trunk rings, and in having a much shorter trunk that is only slightly longer than its head, versus almost twice the length of the head, and from *I. larsonae* in its shorter trunk that increases greatly in depth anteriorly from just behind the head to the origin of the dorsal fin, versus a nearly even depth over the same distance.

ACKNOWLEDGMENTS. I thank Á. Lumnitzer for collecting the type specimens and M. Brooke for sharing his observation data of *Idiotropiscis lumnitzeri* and for the use of his underwater photograph. Radiographs were provided M. Gomon (NMV). M. McGrouther (AMS) and D. Bray (NMV) assisted with loans from their respective institutions.

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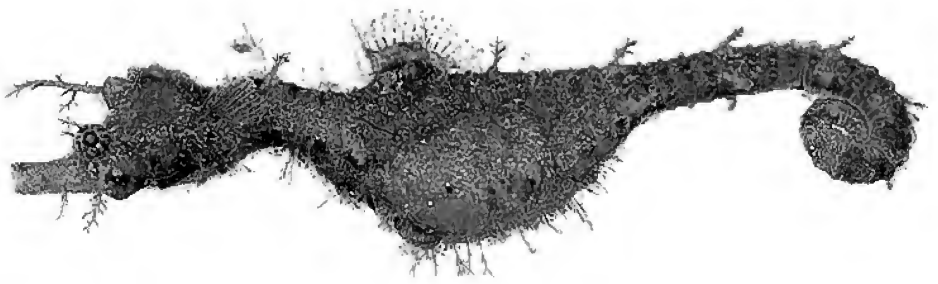

Fig. 1. *Idiotropiscis lumnitzeri*, AMS I.38660-001, holotype, male, 55 mm TL, Sydney, New South Wales. Photograph by Stuart Humphrey.

Fig. 2. *Idiotropiscis lumnitzeri*, male and female, approximately 45 mm TL, Cronulla, Sydney, New South Wales. Photograph by Matthew Brooke.

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Description of a New Species of Butterflyfish, *Roa australis*, from Northwestern Australia (Pisces: Perciformes: Chaetodontidae)

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ABSTRACT. A new species of butterflyfish (genus *Roa*) is described from the North-West Shelf of Western Australia and the Arafura Sea. *Roa australis* n.sp., the only known species of the *Roa modesta*-complex in the southern hemisphere, is most similar to *Roa excelsa* from the Hawaiian Islands, differing from it most noticeably in having narrower and fainter brown bars, white instead of brown anterior dorsal spines, and subequal 3rd and 4th dorsal spines rather than a distinctly longer 3rd spine.

KUITER, RUDIE H., 2004. Description of a new species of butterflyfish, *Roa australis*, from northwestern Australia (Pisces: Perciformes: Chaetodontidae). *Records of the Australian Museum* 56(2): 167–171.

The new species and three close relatives comprise the small Indo-Pacific genus *Roa* (Jordan, 1923), and as a group they are often referred to as the "*modestus* species complex" of the genus *Chaetodon*. They have widely separated distributions: *R. jayakari* (Norman, 1939) occurs in the northwestern Indian Ocean from the west coast of India to the Red Sea; *R. excelsa* (Jordan, 1921) is known from the Hawaiian Islands and Guam; *R. modesta* (Temminck & Schlegel, 1844) occurs in subtropical waters of Japan, ranging south into the China Seas, Taiwan and the Philippines. Records of *R. modesta* from northwestern Australia are based on the new species *R. australis*. The species of this small butterflyfish genus are normally confined to moderate depths, usually in excess of 100 m, and reported to almost 300 m. Only *R. modesta* regularly enters shallow depths in Japanese waters. *Roa excelsa* has been reported as shallow as 20 m in Hawaii (Allen *et al.*, 1999), but the species normally lives at depths greater than 100 m. *Roa jayakari* has been photographed from a submersible in the Red Sea at a depth of 180 m (Kuiter, 2002), and an unidentified species of butterflyfish, photographed from a submersible in the Comoro Island at about 200 m, although differently coloured, may belong to this genus (Kuiter, 2002). The four species share a banded pattern of alternating broad brown and pale bands, and have a distinctive, about eye-sized, black spot on the soft dorsal fin. All have been referred to *Roa modesta* (or, more often as *Chaetodon modestus*) by various authors, because the various species are so similar.

In contrast to most other butterflyfishes, that are popular with divers and aquarists, the species of *Roa* have received little attention. Specimens are generally collected by trawl and are of no interest to fisheries, and regarded as a trash species. In compiling information for a book on the butterflyfishes of the world (Kuiter, 2002), it became clear that there was a great deal of confusion about the identities of this small group of butterflyfish species referred to as the *modestus* species complex. Most authors have considered Jordan's genus *Roa* to be, at best, a subgenus of *Chaetodon* Linnaeus. Blum (1989), however, reinstated Roa to generic status, based on an unpublished cladistic analysis in his PhD thesis. Ferry-Graham *et al.* (2001) reanalysed Blum's previously unpublished data, and agreed that *Roa* was a monophyletic group of 3 species distinct from

Chaetodon: however they chose not to recognize this in their classification and listed *Roa* as subgenus of *Chaetodon*. In contrast, Pyle (2001) and Kuiter (2002), recognized *Roa* at the generic level based on Blum's analysis, and this is followed here in the present paper describing a new species.

Methods

General terminology and methodology follows that of Kuiter & Debelius (1999). Institutional acronyms follow Leviton *et al.* (1985). The Diagnosis refers to the holotype only, whereas the Description includes the paratypes.

Roa australis n.sp.

Fig. 1; Tables 1, 2

Chaetodon modestus (*non* Temminck & Schlegel, 1844); Gloerfelt-Tarp & Kailola, 1984: 220; Sainsbury *et al.*, 1985: 245.

Type material. HOLOTYPE: WAM P.26215-001 (1, 112 mm SL) off Port Hedland, Western Australia, 18°24'S 119°02'E, 140 m, Sainsbury *et al.*, 29 May 1978. PARATYPES: AMS I.21835-018 (14, 69.5–81 mm SL) Arafura Sea, Northern Territory, from 09°21'S 133°12'E to 09°22'S 133°10'E 156–164 m, CSIRO Soela, Otter trawl, 5 November 1980; AMS I.22805-006 (6, 81–119 mm SL) 170 km north of Port Hedland, Western Australia, 18°24'S 118°15'E, 150–156 m, J. Paxton & M. McGrouther, 28 March 1982; CSIRO CA993 (1, 98 mm SL) northeast of Port Hedland, Western Australia, from 18°08'S 119°22'E to 18°07'S 119°21'E 161–173 m, FRV Soela, Frank & Bryce demersal trawl, CSIRO, 12 June 1980; CSIRO CA2188 (1, 102 mm SL) northwest of Admiralty Gulf, Western Australia, from 13°44'S 124°15'E to 13°43'S 124°11'E, 120–121 m, RV Hai Kung, bottom trawl, CSIRO, 28 March 1981; CSIRO CA4072-02 (1, 105 mm SL) north of Port Hedland, Western Australia, from 18°30.6'S 118°43.5'E to 18°31.8'S 118°45.3'E, 145–140 m, FRV Soela, Frank & Bryce demersal trawl, A. Graham & G. Yearsley (CSIRO), 12 June 1980; NMV A2007 (1, 71 mm SL) northwest of Cape Voltaire, Western Australia, from 13°22'S 124°45'E to 124°48'E, 120 m, sand bottom, C.C. Lu, RV Hai Kung, bottom trawl, Cruise 81–HK-2, 29 Mar 1981; NT S12974-003 (5, 82–114) Arafura Sea, Northern Territory, HL90–46, 107–109 m, Helen Larson, 30 Oct 1990; NT S13523-002 (2, 92 & 94) Arafura Sea, Northern Territory, RW92–6, 97–103 m, R. Williams, 18 Sep 1992.

Diagnosis. Dorsal-fin rays XI, 20; anal-fin rays III, 17; pectoral-fin rays 14; tubed lateral-line scales 43; body depth 73.2% in SL; colour light brown, body uniformly pale, head somewhat darker, a dark elongated spot on soft dorsal fin between 2nd and 7th ray, bordered anteriorly by a pale area of similar width, and extending onto membrane between last spine and first ray.

Description. Dorsal fin rays XI, 19–23 (one specimen with X, 25, appears to be aberrant), spines long and broadly compressed near the base, proportionally shortening with growth, length of first spine 6.2–8.8 in SL, length of second spine 13.4–21.0 in SL (more than twice length of first), length of third spine 21.3–35.4 in SL (more than three times length of first), length of fourth spine 25.6–37.1 (usually slightly longer than third), following spines progressively shorter, last spine about equal in length to first soft ray, its length 17.6–23.9 in SL, soft rayed section follows sharp descent of body with gradually and progressively shorter rays; anal-fin rays III, 16–18, its second spine very long, reaching past third spine when spines depressed and pointing posteriorly, soft section mirroring soft part of dorsal fin; pectoral fin 13–16, usually 15 (36), 14 (10), or 16 (6) and rarely 13 (1); lateral-line scales 37–46, most with 39–41 (c. 60%).

Body deep, 63.6–75% in SL, increasing proportionally with growth, and strongly compressed, 14–19.4% in SL; head profile steep above eye, and large, the length 36.1–42% in SL, shortening proportionally with growth; snout moderately long, its length 28.2–34.6% in HL, shortening proportionally with growth; eye diameter slightly greater than length of snout, 30.1–36.1% in HL, reducing in size proportionally with growth; interorbital narrow, 19.6–27.3% in HL, increasing in width proportionally with growth; caudal peduncle moderately deep, its depth 11.3–14.1% in SL, and short, 4.6–6.4% in SL, the latter shortening proportionally with growth.

Origin of dorsal fin high above posterior end of head, the fin base long, its spinous section deeply incised and the base mostly horizontal, curving gradually downward from last few spines to caudal peduncle with soft section strongly angled downward, and the posterior margin of the fin vertical, base length of spinous and soft section equal in large specimens, soft section slightly shorter than spinous section in small specimens; anal fin directly below soft section of dorsal fin, mirroring its shape; ventral fin with strong spine and filamentous first soft ray.

Body and head covered with large ctenoid scales, gradually becoming smaller on nape and snout, extending far onto the median fins, ventral fin with an auxiliary scale, lateral line with tubed scales, rising at steep angle from origin with about 20 scales in an almost straight line, bending abruptly downward, following contour of soft dorsal fin, ending on caudal peduncle. Largest specimens examined 119 mm SL.

Preserved coloration (in alcohol). Large individuals uniformly pale brown, except for dark spot on soft dorsal fin, accompanied by an anterior pale band. Small individuals have strongly faded banding as described below in colour in life.

Live coloration white overall with three vertical brown to ochre bands, first, about pupil-width, from dorsal origin through eye and over cheek; second from below 4th and 5th dorsal spines, narrowing gradually and reaching to middle of abdomen; and 3rd from below last 3–4 dorsal spines towards caudal peduncle, narrowing and continuing onto anal fin to the end of its first soft ray; all fin spines white; first and second dorsal fin-spine membranes with black pigmentation; a black elongate spot on soft dorsal fin between 2nd and 7–8th rays with a broad white border anteriorly, the white extending ventrally slightly beyond the black, and a submarginal white band in the soft dorsal and anal fins; caudal fin clear with pale ochre basally; soft part of ventral fin brown to dusky ochre with black margin and tip.

Etymology. *australis*, from the Latin, meaning southern, in reference to its southern Hemisphere distribution.

Distribution. *Roa australis* occurs off the northwest coast of Australia. The species ranges from just south of the Rowley Shoals, northwest of Port Hedland, Western Australia to the Arafura Sea, Northern Territory. Specimens were collected between 97 and 173 m depth.

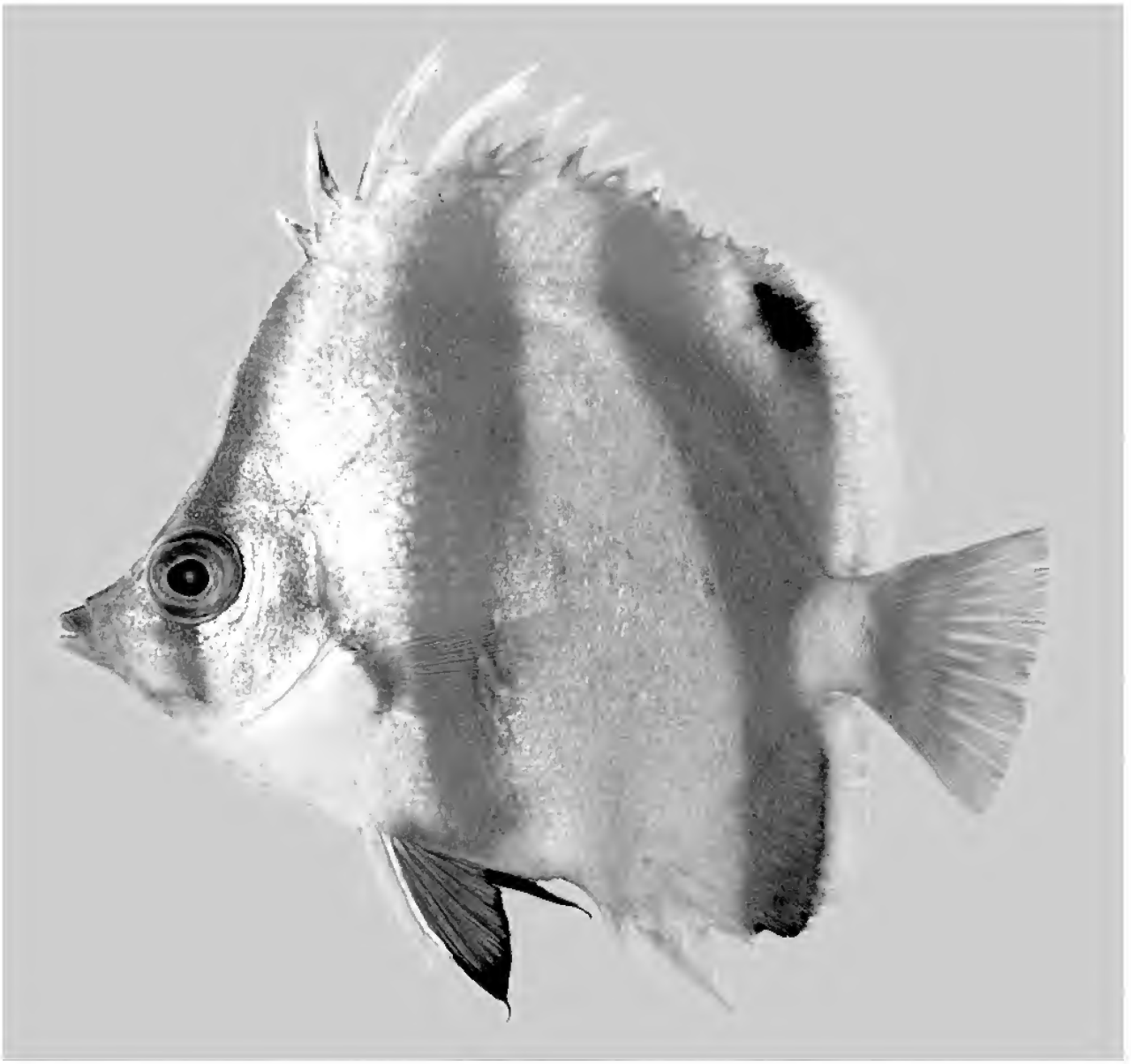

Fig. 1. *Roa australis* n.sp., holotype, WAM P.26215-001 (112 mm SL) off Port Hedland, Western Australia. Photograph by Barry Hutchins.

Fig. 2. left to right. *Roa modesta*. Osezaki, Japan. Depth 20 m. Length 12 cm TL. Photograph by Rudie Kuiter. *Roa jayakari*. Gulf of Aqaba, Red Sea. Depth 180 m. Photograph by Jürgen Schauer, from submersible. *Roa excelsa*. BPBM 24754. Length 98 mm SL. Photograph of preserved specimen and colouring by Rudie Kuiter after Allen *et al*., 1998.

Table 1. Selected meristic values for species of *Roa*.

	fin rays: dorsal (XI) soft rays					anal (III) soft rays			pectoral[a] soft rays				pored scales[a] lateral line									
	19	20	21	22	23	16	17	18	13	14	15	16	37	38	39	40	41	42	43	44	45	46
Roa australis	1	1	4	18	2	2	16	9	1	10	36	6	6[b]	3	4	12	7	5	1	1	—	1
Roa excelsa	—	1	3	—	—	2	2	—	—	6	—	—	4	—	2	2	—	—	—	—	—	—
Roa modesta	—	—	—	3	—	—	3	—	1	5	—	—	—	—	2	1	3	—	—	—	—	—

[a] Both sides. A single, apparently aberrant individual, *Roa australis* had D. X, 25.
[b] Many specimens have scales missing.

Remarks. The examination of specimens of *Roa australis, R. excelsa*, and *R. modesta* show no significant differences in meristic values (Table 1). Published meristic values of *R. jayakari* (Randall, 1995) fall well within the range of its congeners. Morphometric information on *R. jayakari* was obtained from photographs (Allen *et al*., 1998; Kuiter, 2002). The 4 species show significant differences in morphometrics, but these are complicated by growth changes as shown for 3 of the 4 species (Table 2). Features that are clearly different among species in large specimens do not necessarily differ in small individuals and due to proportional changes with growth, may increase in one species and decrease in another. However colour is markedly different among species (Fig. 2) and diagnostic. Two species, *R. modesta* and *R. jayakari* share similarly marked dorsal fins. Each has a white-edged round ocellus on the soft-rayed section and a mostly black second spine. However, the shape of the spinous section differs, the profile is evenly round in *R. modesta*, versus virtually straight from the 4th to last spine in *R. jayakari. R. modesta* differs from the other 3 congeners in having a ventral broadening of the second dark band and the bands having dark, near black, margins that persist as brown stripes in preservation. *Roa australis* and *R. excelsa* share an elongated black spot on the soft dorsal fin and the black coloration of the second dorsal-fin spine. These two species differ greatly in the width and colour of their dark bands. In *R. australis*, the bands are narrow and do not extend dorsally onto the spines, whereas in *R. excelsa*, the bands are very broad dorsally and almost cover all the dorsal-fin spines, only leaving a small gap of white between the 6th and 8th spine. The species appear to be separated geographically, but distributions are not well understood due to the depths at which *Roa* spp occur.

Table 2. Proportional measurements species of *Roa*. Percentage-range figures are presented respectively to size-range figures, those in italics show a proportional reduction with growth. Those in non-italics show a proportional increase with growth. For each species, n is as per material examined.

		Roa australis 69.5–119 mm %	*Roa excelsa* 94–105 mm %	*Roa modesta* 51.5–97 mm %
	standard length			
body	depth in SL	63.6–75.0	61.0–67.0	66.5–73.2
	width in SL	14.0–19.4	14.9–17.3	15.5–19.3
head	length in SL	*42.0–36.1*	34.9–37.1	*40.9–31.5*
snout	length in HL	*34.6–28.2*	29.3–34.5	*32.7–32.5*
eye	diameter in HL	*36.1–30.1*	*33.6–32.5*	30.8–32.6
interorbital	width in HL	19.6–27.3	*25.3–21.7*	22.7–27.8
caudal peduncle	depth in SL	11.3–14.1	10.2–11.1	12.0–13.3
	length in SL	*6.4–4.6*	4.2–4.9	4.6–5.5
caudal fin	length in SL	*25.9–21.8*	20.0–21.2	*25.6–21.1*
pectoral fin	length in SL	*36.2–29.4*	28.8–33.6	*30.2–26.3*
dorsal-fin base length	spinous in SL	35.8–42.0	*40.1–36.4*	36.2–38.8
	soft in SL	31.7–42.0	*33.9–31.1*	35.3–40.8
dorsal-fin spine length	1st in SL	*8.8–6.2*	7.0–7.7	*9.3–6.4*
	2nd in SL	*21.0–13.4*	15.0–17.3	*22.3–15.9*
	3rd in SL	*35.4–21.3*	33.9–36.5	*30.6–23.4*
	4th in SL	*37.1–25.6*	26.5–32.6	*33.7–26.3*
dorsal-fin soft-ray length	1st in SL	*23.9–17.6*	16.6–21.2	*23.4–19.5*
anal-fin base	length in SL	31.2–37.4	30.6–32.6	36.0–41.8
anal-fin spine length	1st in SL	*13.7–9.3*	*13.2–12.1*	9.7–11.9
	2nd in SL	*28.1–21.8*	*30.0–27.1*	18.7–19.6
	3th in SL	*23.0–18.9*	17.2–20.8	19.6–21.9
anal-fin soft-ray	longest in SL	*23.2–17.5*	18.5–22.3	17.5–26.2
ventral fin	length in SL	*38.1–27.5*	*33.0–29.9*	30.2–37.8
	spine length in SL	*30.2–20.3*	*26.0–23.6*	22.3–25.8

Other material examined. *Roa excelsa*: BPBM 10867 (1, 71 mm SL) Oahu, Hawaiian Islands, 80 fathoms, Otter trawl, Robert Cordover, 25 March 1971; BPBM 10868 (1, 94 mm SL) Oahu, Hawaiian Islands, 75 fathoms, gill net, Thomas Clarke, 19–20 April 1971; BPBM 24754 (1, 105 mm SL) Oahu, Hawaiian Islands, 21°39'N 158°06'W 180–200 m, shrimp trawl, "Townsend Cromwell", cruise 61, station 26, 17 October 1972; BPBM 24827 (1, 71 mm SL) Oahu, Hawaiian Islands, 21°39'N 158°06'W 180–200 m, shrimp trawl, "Townsend Cromwell", cruise 61, station 32, 18 October 1972.

Roa modesta: NT S12725-014 (1, 51.6 mm SL) Wakasa Bay, Japan, 35°30'N 135°45'E, trawl, I. Nakamura, 10 November 1988; WAM P.30260-002 (2, 86 & 97 mm SL) western Wakasa Bay, Japan, 35°30'N 135°45'E, trawl, I. Nakamura, 10 November 1988.

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Two New Species of Roughy (Trachichthyidae: *Optivus*) from Coastal Waters of Southern Australia

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ABSTRACT. Names are provided for two allopatric species of *Optivus* occurring in shelf waters of southeastern and southwestern Australia that have been treated in recent Australian literature. *Optivus agastos* n.sp., distributed from southern Queensland to central Victoria and northeastern Tasmania, and at Lord Howe Island, differs from the very similar *O. elongatus,* which is limited to New Zealand, in having fewer gill rakers (22–24, rarely 25, versus 25–27, rarely 24), slightly smaller eye, longer snout, and enlarged teeth along the inner margin of the premaxilla. *Optivus agrammus* n.sp., distributed from western South Australia to southwestern Western Australia, can be distinguished from congeners most readily by the lack of stripes on its caudal-fin lobes, curved dorsal outline of its nape and head in lateral profile, relatively deeper and shorter caudal peduncle, and lower dorsal and anal fins.

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Whitley (1947) proposed the generic name *Optivus* for *Trachichthys elongatus* Günther, 1859, separating it from *Hoplostethus* Cuvier (in Cuvier & Valenciennes, 1829) by its more elongate form and in having "only four dorsal spines instead of six". Subsequent literature treated the Australasian genus as monotypic (e.g., Paulin, 1979; Kotlyar, 1980), before May & Maxwell (1986) and then Paxton *et al.* (1989) pointed out that two "new species" occur in Australia. Gomon (1994) considered *Optivus* to comprise three species, two allopatric undescribed species occurring in southern Australian waters, and *O. elongatus,* which is restricted to New Zealand. He presented descriptions for the unnamed species, separating them both with a key and diagnostic remarks in the treatment of each. Kotlyar (1996), in a major treatment of beryciform fishes, followed Gomon and presented additional evidence for the recognition of three species in the genus. The purpose of this paper is to provide names and detailed descriptions for the two Australian species.

Materials and methods

Terminology and methodology is that of Hubbs & Lagler (1949), except body depth is measured at dorsal-fin origin, head depth is taken at vertical through upper end of gill opening and jaw length is measured from anterior end of premaxilla to posteroventral corner of maxilla. Strong ctenii, which obscure scale margins, and the nature of merging scale rows above and below the lateral line in *Optivus* species make the determination of scale counts, such as numbers of lateral-line scales, oblique scale rows, scales above and below lateral line and predorsal scales with accuracy difficult. Broad ranges in these values may be attributed in part to this. In Descriptions, parenthetical values refer to paratypes, and all paratypes are included unless noted otherwise. Where structures were damaged, values were not recorded. The number and size range in standard length (mm) for each lot of specimens examined is presented as a parenthetical expression after the respective registration

number. Institutional abbreviations are listed in Leviton *et al.* (1985).

Comparative material of *Optivus elongatus* included: NMNZ 3155 (15, 61.1–82.1); NMNZ P15333 (106); NMNZ P17028 (11, 77.5–108); NMNZ P18423 (20, 16.7–113), all from New Zealand Waters.

Optivus agastos n.sp.

Figs. 1, 2; Tables 1, 2

Trachichthys elongatus (*non* Günther, 1859). Günther, 1859: 10 (*partim*); Waite, 1898: pl. V.

Hoplostethus elongatus (*non* Günther, 1859). McCulloch, 1923: 14; 1929: 132 (*partim*); Marshall, 1964: 129 (*partim*); Allen *et al.*, 1976: 387 (*partim*).

Optivus elongatus (*non* Günther, 1859). Whitley, 1964: 40; McKnight, 1972: 154 (*partim*); Shimizu, 1977: 192; Kotlyar, 1980: 217 (*partim*); Paulin, 1979: 70 (*partim*); Last *et al.*, 1983: 275 (*partim*); Hutchins & Swainston, 1986: 38 (*partim*); Kotlyar, 1992: 38; Kuiter, 1993: 72; Kuiter, 1996: 58.

Optivus sp. 1.—May & Maxwell, 1986: 220; Gomon, 1994: 406; Kotlyar, 1996: 180.

Optivus n.sp.—Paxton *et al.*, 1989: 365; Johnson, 1999: 725.

Type material. HOLOTYPE: NMV A24972-001 (90.3) Cape Wellington, Wilsons Promontory, Victoria, 39°04.1'S 146°28.6'E, rotenone, 2 February 1982, Kuiter, R.H. & M. McDonald. PARATYPES: AMS I.30408-007 (97.2), northeast of Wooli, New South Wales, 29°52'S 153°25'E to 29°48'S 153°26'E, 64 m, 2 May 1990, trawl, FRV Kapala; AMS I.31476-005 (2, 64.3–91.5), off Murwillumbah, New South Wales, 28°20'S 153° 40'E to 28°25'S 153°41'E, 54–58 m, 15 August 1978, prawn trawl, FRV Kapala; CSIRO H.3509-01 (76.6), east of Lakes Entrance, Victoria, 37°55.5'S 148°12.4'E to 37°55.1'S 148°15.1'E, 42 m, 30 July 1993, demersal trawl, FRV Southern Surveyor, SS05/93/102; CSIRO H.3989-02 (82.0), northeast of Newcastle, New South Wales, 32°52'S 151°54'E, 29–33 m, 19 April 1995, demersal trawl, FRV Kapala, K 95-03-10; CSIRO T1922 (95.2), White Rock, Tasmania, 42°25'S 148°09'E, 96 m, 22 April 1980; NMV A2582 (80.0), Brown Head, west shore, Wilsons Promontory, Victoria, 39°02.7'S 146°28.3'E, 0–16 m, 10 February 1982, rotenone, Cochrane, T.G., Kuiter, R.H. & Larsen, M.; NMV A2737 (4, 66.6–81.0), Horn Point, north shore, Wilsons Promontory, Victoria, 39°01.6'S 146°28.2'E, 8 February 1982, Kuiter, R.H. & M. McDonald; NMV A3207 (46.5), Portsea, Port Phillip Bay, Victoria, 38°19'S 144°43'E, 10 m, 11 August 1982, quinaldine, Kuiter, R. H.; NMV A24972-002 (5, 56.4–92,5) same data as holotype; QM I.29706 (83.7) southeast of Point Lookout, Stradbrook Island, Queensland, 27°31'S 153°40'E, 80 m, trawl, 21 March 1995, collected by R. Joyce; QM I.32705 (76.1) northeast of Cape Moreton, Queensland, 26°57'S 153°32'E, 104 m, trawl, 12 March 2001, Queensland Fisheries Service; WAM P.25739-007 (83.6), Moreton Bay, 11.3 km (7 mi) northwest of Cape Moreton, southeastern Queensland, 23 February 1975, collected by R.J. McKay; WAM P.28843-001 (84.8), Port Hacking, New South Wales, 34°04'S 151°07'E, trawl, 14 November 1974, collected by CSIRO.

Non-type material. Lord Howe Island AMS IA.678 & 679 (2, 76.6–85.8); Sydney Harbour AMS IB.7384 (15, 34.7–49.4); Sydney Harbour AMS I.40840-034 (12, 53.1–77.0).

Diagnosis. Gill rakers 22–25, modally 23; lateral profile of nape and head nearly straight in lateral profile, distinctly angled downward in front of dorsal fin; snout tip rounded, usually projecting slightly in front of upper jaw; depth of head at vertical through upper end of gill opening 2.9–3.2 times in SL; snout length 1.6–2.7 times in eye diameter; inner row of teeth on premaxilla noticeably longer than others; caudal peduncle relatively short and deep, depth 0.9–1.3 times in length; dorsal and anal fins relatively low, third segmented dorsal-fin ray 3.5–4.2 times in SL, first anal-fin ray 5.2–6.3 times in SL; body greenish brown on back, silvery below; fins almost uniformly pink, though slightly dusky tips to caudal-fin lobes persisting in recently preserved large specimens.

Description. Dorsal-fin rays IV, 11 (V, 10 in one of 22 paratypes); anal-fin rays III, 9 (III, 10 in 2); caudal-fin rays 7 (8 in 1) + 19 (18 in 1) + 6; pectoral-fin rays 12 (11 in 2 and 13 in 5 of 36 fins counted); vertebrae 12 + 14; lateral-line scales 28 (26–27); scales above lateral line approximately 12 (11–13); scales below lateral line approximately 18 (16–18); predorsal scales approximately 32 (31–36); ventral scutes 11 (9–13); total gill rakers 23 (20–24, modally 23; Table 2). (See Table 1 for morphometric values).

Body of moderate depth; caudal peduncle short and deep, tapering slightly posteriorly; anus positioned well behind pelvic-fin bases, just in advance of anal-fin origin; no apparent luminescent tissue. Head and snout rounded; dorsal outline of nape and head nearly straight in lateral profile, distinctly angled downward in front of dorsal fin; snout short, usually projecting slightly in advance of mouth; posttemporal spine short and sharp. Posterior edge of preopercle finely serrate, posteroventral corner produced as broad spine reaching just beyond hind edge of operculum. Dorsoposterior corner at rear end of maxilla posterior to vertical through posterior margin of orbit. Gill rakers on upper limb of first arch long and slender.

Oral edge of premaxilla and dentary broadly covered with fine teeth, those in row on ventral-most edge of premaxilla only slightly, but noticeably longer than those on either side; dentigerous surface extending laterally around expanded anterior end of dentary to underside. Vomer naked; palatine covered with fine teeth.

Scales adherent, each with numerous rows of strong ctenii obscuring scale margins and making determination of squamation patterns difficult; single row of scales overlapping onto bases of dorsal and anal fins. Predorsal scales on dorsal midline of head reaching just in advance of vertical through centre of orbit on dorsal midline of head. Cheek scales reaching forward just in advance of vertical through posterior extent of orbit. Lateral-line pores mostly obscured by ctenii. Scales on ventral midline between pelvic-fin bases and anus modified as moderately large bony scutes.

Dorsal fin short based, continuous, spines and rays increasing in length progressively to third soft ray, subsequent rays gradually decreasing in length; first soft ray unbranched, remaining rays branched; origin of fin above centre of pectoral fin. Anal fin short based, first spine tiny, spines and rays increasing in length progressively to second soft ray, subsequent rays subequal or decreasing slightly in length. Caudal fin distinctly forked. Posterior edge of pectoral fin curved, middle rays longest, first and last rays simple and short, second longer but also simple,

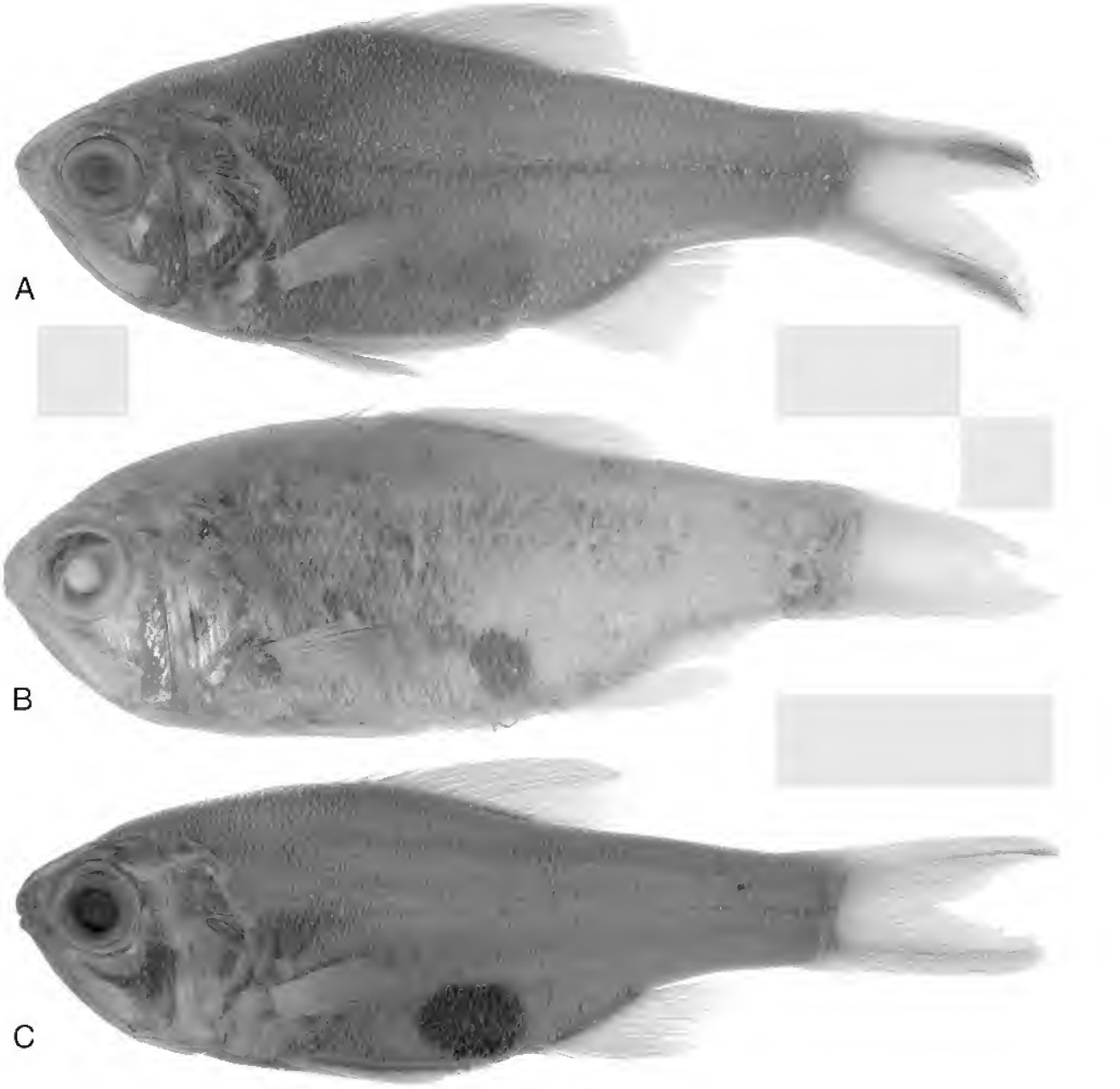

Fig. 1. Specimens of the three species of *Optivus*: (*A*) *O. agastos* n.sp., holotype, NMV A24972-001 (90.3 mm SL) Cape Wellington, Wilsons Promontory, Victoria; (*B*) *O. agrammus* n.sp., holotype, CSIRO H.5316-08 (86.7 mm SL) central Great Australian Bight, South Australia; and (*C*) *O. elongatus* NMNZ P17028 (82.7 mm SL), Seal Rock Group, Sugar Loaf Islands, New Plymouth, New Zealand. The dark area above the anal region in all three images is not pigmentation, but appears to be an artifact of preservation that is frequently present in specimens, though variable in size, shape and intensity.

others branched. Posterior tip of pelvic fin reaching about two thirds of way to anal-fin origin.

Preserved coloration (in alcohol). Pale to slightly dusky, body darkest dorsally; dorsal fin sometimes with dusky smudge dorsally; each caudal-fin lobe with dark longitudinal stripe.

Live coloration (see colour photo in Gomon, 1994, fig. 364). Deep violet brown dorsally, silvery violet below; fins translucent; medial fins whitish basally and distally, pink centrally; caudal fin with prominent longitudinal brown stripe on each lobe; dorsal fin with brown smudge distally; pectoral fin pink; pelvic fin pinkish white.

Etymology. *agastos*, Greek meaning "near kinsman" in reference to the similarity and presumed close relationship of this species to the type of the genus.

Distribution. Restricted to southeastern Australia between Noosa, Queensland in the north, Lord Howe Island to the east, Port Phillip Bay, Victoria to the west and Freycinet, Tasmania in the south, in the vicinity of reefs at depths of 1–146 m.

Comments. Günther (1859) described *Trachichthys elongatus* on the basis of a "skin, in spirits" from Great Barrier Island, New Zealand, purchased from Sowerby and subsequently registered as BMNH 1850.12.3.1 and "young" from Australia, presumably BMNH 1854.11.1.7 (40.5). Registration details and the jar label accompanying the latter lack locality information, recording only "purchased of Mr Stevens" (A.C. Gill, pers. comm.). The measurements provided with Günther's description are clearly of an adult specimen and approximate those of the New Zealand specimen (c. 82 mm SL). The figure cited at the beginning of Günther's species account apparently was not published. The New Zealand specimen is here designated lectotype. The presumed Australian specimen, despite having paralectotype status, is likely to represent the species described above.

Superficially, *O. agastos* closely resembles *O. elongatus* both morphologically and with respect to coloration. It differs from the latter in usually having fewer gill-rakers on the front of the first gill arch (22–24, rarely 25, versus 25–27, rarely 24; Table 2), slightly smaller eye and longer snout, and taller teeth along the inner margin of the jaws, rather than teeth that are little, if at all enlarged.

Values for the number of oblique scale rows for the three species presented by Kotlyar (1996) that distinguish between *O.* sp. 1 (= *O. agastos*) and *O. elongatus* do not match those recorded for this study. Specimens of *O. elongatus* listed above have 59–71 rows (47–51 in Kotlyar), whereas those of *O. agastos* have 63–71 (62–71 in Kotlyar). The discrepancy is likely attributable to the difficulty in identifying individual scale rows associated with scale structures and patterns, discussed above in Methods and Materials.

Gomon (1994) stated that *O. elongatus* occurs at Lord Howe Island, as well as in New Zealand. The two Australian Museum specimens on which the statement was based (listed above in Non-type material) have characters consistent with *O. agastos*, including a gill-raker count of 24.

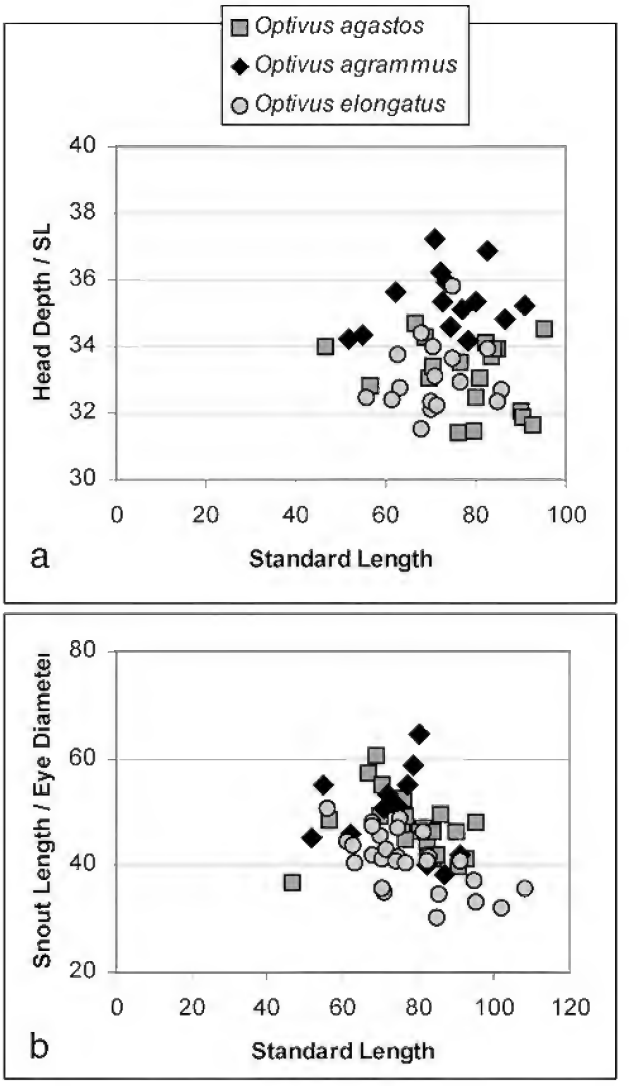

Fig. 2. Comparison of selected morphometric values in the three species of *Optivus*: (*a*) head depth versus head length relative to standard length; and (*b*) snout length versus eye diameter relative to standard length.

Optivus agrammus n.sp.

Figs. 1, 2; Tables 1, 2

Optivus elongatus (*non* Günther, 1859). McKay, 1970: 6; Kotlyar, 1980: 217.

Optivus n. sp.—May & Maxwell, 1986: 220; Paxton *et al.*, 1989: 365.

Optivus sp. 2.—Gomon, 1994: 407, fig. 365; Kotlyar, 1996: 182.

Type material. HOLOTYPE: CSIRO H.5316-08 (86.7), central Great Australian Bight, South Australia, 31°50'S 130°45'E, 54 m, trawl, 14 May 2000, SS01/00/380, FRV Southern Surveyor. PARATYPES: CSIRO CA3459 (70.9), south of Point Dover, Great Australian Bight, Western Australia, 32°50'S 125°31'E to 32°48'S 125°32'E, 50–44 m, trawl, 7 March 1979, F.V. Courageous; CSIRO CA3460 (82.4), south of Point Dover, Great Australian Bight, Western Australia, 32°50'S 125°31'E to 32°48'S 125°32'E, 50–44 m, trawl, 7 March 1979, F.V. Courageous; CSIRO H.5316-09 (3, 76.9–91.0), same data as holotype; NMV A24987-001 (73.5), 6 mi (9.6 km) off Venus Bay, South Australia, 18–25 fms (33–46 m), June 1982, T. Olsen; SAMA A478 (72.7), presumably 34°25.0'S 133°25'E to 34°25.0'S 133°23'E, 128–130 m, 15 August 1981, SO3/81/65, FRV Soela; SAMA A744 (2, 72.0–74.3), western Great Australian Bight, Western Australia, 33°15'S 125°24'E to 33°13'S 125°24'E, 60–61 m, 29 July 1981, SO3/81/13, FRV Soela; SAMA A776 (51.7), western Great Australian Bight, Western Australia, 34°10'S 124°31'E to 34°11'S 124°32'E, 320–380 m, 29 July 1981, SO3/81/9, FRV Soela; SAMA A1664 (80.0), same data as NMV A24987-001; WAM P.15263 (62.3), Lookout Point, Cheyne Beach, Western Australia, 34°53'S 118°25'E, trawl, 19 April 1980, B. Hutchins *et al.*; WAM P.26608-08 (54.7), west of Fremantle, Western Australia, 32°09'S 114°27'E, trawl, 1965, Suruga Maru.

Diagnosis. Gill rakers 20–24, modally 22; lateral profile of nape and dorsal surface of head gently curved, nearly horizontal in front of dorsal-fin origin, almost straight between eyes; tip of snout broadly rounded; depth of head at vertical through upper end of gill opening 2.7–2.9 times in SL; snout length 1.5–2.6 times in eye diameter; inner row of teeth on premaxilla noticeably longer than others;

Table 1. Selected morphometric values expressed as a percent of standard length for the holotype and paratypes of *Optivus agastos* n.sp., *O. agrammus* n.sp., and for examples of *O. elongatus*.

	***Optivus agastos* n.sp.** Eastern Australia		***Optivus agrammus* n.sp.** Western Australia		***O. elongatus*** New Zealand
	holotype	paratypes	holotype	paratypes	
number of specimens: standard lengths	90.3	22: 56.4–95.2	86.7	13: 51.7–91.0	23: 55.8–108
body depth	39.6	33.6–40.2	38.0	37.1–41.9	33.9–38.3
head length	33.7	33.0–35.8	34.0	32.6–37.2	32.9–35.8
head depth	31.9	31.4–34.7	34.8	34.2–37.2	31.5–34.4
eye diameter	10.6	10.2–12.9	10.8	10.2–12.5	11.0–13.2
snout length	4.2	4.5–6.7	4.2	4.2–6.7	3.7–5.8
jaw length	20.8	20.6–21.7	20.0	20.0–22.4	—
caudal-peduncle depth (ant.)	20.7	19.1–22.6	21.6	20.3–24.1	18.1–20.4
caudal-peduncle depth (post.)	16.1	14.8–17.1	16.4	15.9–18.1	14.4–16.7
caudal-peduncle length	24.9	20.6–25.3	20.4	20.0–23.1	17.8–23.0
dorsal-spine length (1st)	3.4	2.1–5.3	3.5	1.8–4.7	—
dorsal-spine length (4th)	12.7	11.5–15.5	9.4	7.1–12.4	—
dorsal-ray length (1st)	18.3	17.4–23.1	16.0	14.6–20.1	—
dorsal-ray length (3rd)	24.8	23.7–28.9	21.7	21.7–25.7	25.2–29.1
dorsal-ray length (11th)	12.1	9.3–15.2	13.4	12.0–13.9	—
anal-spine length (1st)	1.6	1.2–3.2	1.0	0.8–2.2	—
anal-spine length (3rd)	10.4	9.2–11.9	7.7	7.7–11.7	—
anal-ray length (1st)	15.7	16.0–19.3	14.8	12.2–18.0	16.2–20.2
anal-ray length (9th)	12.7	10.8–14.0	12.6	11.6–13.5	—
caudal-fin length (upper lobe)	29.9	27.7–33.3	31.5	26.1–31.5	—
pectoral-fin length	19.3	19.0–22.5	20.3	17.0–20.9	—
pelvic-fin length	20.3	19.1–22.7	19.8	19.2–22.3	—

caudal peduncle relatively short and deep, depth 0. 9–1.2 in length; dorsal and anal fins relatively low, third segmented dorsal-fin ray 3.8–4.6 times in SL, first anal-fin ray 5.6–8.2 times in SL; body greenish brown on back, silvery below; fins almost uniformly pink, though slightly dusky tips to caudal-fin lobes persisting in recently preserved large specimens.

Description. Dorsal-fin rays IV, 11 (III, 11 and IV, 10 in two of 13 paratypes); anal-fin rays III, 9 (III, 10 in 1); caudal-fin rays 6 (7 in 12) + 19 + 6 (5 in 2); pectoral-fin rays 12 (11 in 2 and 13 in 1 of 26 fins counted); vertebrae 12 + 14; lateral-line scales 26; scales above lateral line approximately 9 (9–11); scales below lateral line approximately 12 (12–15); predorsal scales approximately 27 (27–29); ventral scutes 11 (9 in 3 and 10 in 5); total gill rakers 22 (20–24, modally 22; Table 2). (See Table 1 for morphometric values).

Body of moderate depth; caudal peduncle rather short and deep, tapering only slightly posteriorly; anus positioned well behind pelvic-fin bases, just in advance of anal-fin origin; no apparent luminescent tissue. Head and snout rounded; dorsal outline of nape and head gently curved in lateral profile, nearly horizontal in front of dorsal fin, almost straight between eyes; snout short, not projecting in advance of mouth; posttemporal spine short and sharp. Posterior edge of preopercle finely serrate, posteroventral corner produced as broad spine reaching nearly to hind edge of operculum. Dorsoposterior corner at rear end of maxilla positioned vertically below posterior margin of orbit. Gill rakers on upper limb of first arch long and slender.

Oral edge of premaxilla and dentary broadly covered with fine teeth of similar size, dentigerous surface extending laterally around expanded anterior end of dentary to underside. Vomer naked; palatine covered with fine teeth.

Scales adherent, each with numerous rows of strong ctenii obscuring scale margins and making determination of squamation patterns difficult; single row of scales overlapping onto bases of dorsal and anal fins. Predorsal scales on dorsal midline of head reaching just in advance of vertical through centre of orbit on dorsal midline of head. Cheek scales reaching forward just in advance of vertical through posterior extent of orbit. Lateral-line pores mostly obscured by ctenii. Scales on ventral midline between pelvic-fin bases and anus modified as moderately large bony scutes.

Dorsal fin short based, continuous, spines and rays increasing in length progressively to third soft ray, subsequent rays gradually decreasing in length; first soft ray unbranched, remaining rays branched; origin of fin above centre of pectoral fin. Anal fin short based, first spine tiny, spines and rays increasing in length progressively to second soft ray, subsequent rays subequal or decreasing slightly in length. Caudal fin distinctly forked. Posterior edge of pectoral fin curved, middle rays longest, first and last rays simple and short, second longer and also simple, others branched. Posterior tip of pelvic fin reaching about two thirds of way to anal-fin origin.

Table 2. Frequency of gill-raker counts in the three species of *Optivus* as reflected in specimens examined.

	gill-raker number							
	20	21	22	23	24	25	26	27
Optivus agastos			1	9	9	1		
Optivus agrammus	1	1	7	4	1			
Optivus elongatus					1	8	5	2

Preserved coloration (in alcohol). Body and fins pale; large, recently preserved individuals with slightly dusky caudal-fin tips.

Live coloration. See colour photo in Gomon, 1994 (fig. 365). Greenish brown on back, silver below; fins pink.

Etymology. *agrammus*, from the Greek *a*, meaning "without", and *gramme*, for "line", in reference to the absence of stripes on the caudal fin of this species.

Distribution. Known only from western and central southern Australia, between Fremantle, Western Australia and Venus Bay, South Australia, at the eastern end of the Great Australian Bight, in depths of 40–320 m.

Discussion. Freshly preserved individuals of *Optivus agrammus* are readily separable from the other two species of *Optivus* by colour pattern, the former lacking the distinctive lengthwise dark stripe on each of the caudal-fin lobes found in its congeners (see colour photos in Gomon, 1994, of *O. agastos*—fig. 364 and *O. agrammus*—fig. 365, and Doak, 1972, of *O. elongatus*—pl. 8, as *Hoplostethus elongatus*). Other features that differ between it and its congeners relate to the overall shape of the head, body and fins and are evident as morphometric shifts, with overlapping values (Table 1). The distribution of characters in the species do not support any clear relationships (e.g., Fig. 2). Although *O. agrammus* has modally fewer gill-rakers than *O. agastos,* both have less than *O. elongatus* (Table 2). The use of the distribution of cheek scales by Gomon (1994) to separate *O. agastos* and *O. agrammus* (as *O.* sp. 1 and *O.* sp. 2, respectively) is invalid as the character is more variable than described.

The precise collection site of the paratype SAMA A478 is unclear, due to incomplete registration information. The specimen was recorded as coming from a Soela station "65" without further details. It is surmized that the specimen was taken on the same Soela cruise as the other two specimens sent to the South Australian Museum by CSIRO, both of which were registered later than this specimen, rather than from one of the three subsequent cruises to the Bight region by the vessel.

ACKNOWLEDGMENTS. I am grateful to M. McGrouther (AMS), A. Graham (CSIRO), J. Johnson (QM), A. Stewart (NMNZ), the late C.J.M. Glover (SAMA), B. Hutchins and G. Moore (WAM) for facilitating loans of specimens. Thanks to A. Gill (BMNH) for reporting on types of *O. elongatus*. CSIRO Marine Labs and B. Hutchins also kindly provided photographs of freshly caught specimens.

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Two New Species and Two New Records of Aploactinid Fishes (Pisces: Scorpaeniformes) from Australia

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ABSTRACT. Two new species of aploactinids are described from coastal waters of subtropical eastern Australia. *Pseudopataecus taenianotus*, new genus and species, is described from seven specimens trawled inside the Capricorn-Bunker Group, Queensland. It is readily distinguished from other aploactinids by the markedly compressed head and body, large number of dorsal and anal-fin ray elements, frontal bone with laterally-bowed ridges forming a shallow fleshy depression, and distinctly anterior insertion of the first dorsal spine. *Cocotropus microps*, new species, is described from three specimens collected from inshore waters of southern Queensland and northern New South Wales. It has the lowest dorsal- and anal-fin ray counts of the genus, dorsal fin forming three elevated sections, and coloration including at least several small pale irregular spots or larger blotches.

Two aploactinid species are recorded in Australian waters for the first time. *Acanthosphex leurynnis* Jordan & Seale, 1905, previously known from Hong Kong, Gulf of Thailand, southeast India, Indonesia and eastern Papua New Guinea, is reported from the Cumberland Group in tropical eastern Australia, Arafura Sea, Northern Territory, and near Perth, Western Australia. *Xenaploactis cautes* Poss & Eschmeyer, 1980, previously known only from the Andaman Sea and Gulf of Thailand, is reported from off Dampier, northwestern Australia and Gulf of Carpentaria, Queensland.

JOHNSON, J.W., 2004. Two new species and two new records of aploactinid fishes (Pisces: Scorpaeniformes) from Australia. *Records of the Australian Museum* 56(2): 179–188.

With the addition of the two new taxa described here, the Aploactinidae (velvetfishes) now contains 42 species belonging to 18 genera (Table 1), 11 of which are monotypic (Poss & Eschmeyer, 1978, 1979, 1980; Poss, 1982, 1986, 1999; Poss & Springer, 1983; Washington *et al.*, 1984; Poss & Allen, 1987; Poss & Johnson, 1991; Eschmeyer, 1998; Imamura & Shinohara, 2003). The family is restricted to the western Pacific and Indian oceans, and most species occur solely in the Australian and Indo-Malaysian regions. Including the two species recorded here for the first time, 20 species in 14 genera are now known from Australian waters. Most species appear to live among vegetation, or rocky, shelly, coral rubble, or coralline algae substrata. Velvetfishes are most commonly collected from among prawn trawl bycatch.

Collections from scallop trawling inside the Capricorn-Bunker Group of subtropical eastern Australia have yielded a distinctive new genus and species of aploactinid fish. It appears to be highly restricted in distribution, with no other specimens collected throughout the Australian region, despite numerous trawl surveys covering similar depth ranges and habitat.

A new species of the genus *Cocotropus* is also described, expanding the largest genus of velvetfishes to 10 species: *C. echinatus* (Cantor, 1849) from Malaysia, *C. dermacanthus* (Bleeker, 1852) from Indonesia and the Seychelles, *C. roseus* Day, 1875 from the Coromandel coast of India and the Maldives, *C. altipinnis* Waite, 1903 from Lord Howe and Kermadec Islands, *C. monacanthus* (Gilchrist, 1906)

Table 1. Selected meristic and morphological features of the family Aploactinidae (meristics after Washington *et al.*, 1984, supplemented and revised).

genus	spp	dorsal spines	dorsal rays	dorsal total	anal spines	anal rays	pectoral rays	pelvic rays	vertebrae	pungent spines	dorsal fin insertion[a]	gill opening[b]	isthmus extension	squamation[c]	interorbit. ridges[d]
Acanthosphex	1	11–15	7–9	19–22	1–2	6–8	9–10	I+2	24–26	Y	pO	R	N	S	M, Para
Adventor	1	13	7–9	21–23	1	8–10	12–14	I+2	27–28	N	P	NR	Y	dV	S, sl Div
Aploactis	1	12–15	11–15	24–28	1–3	10–12	11–14	I+2	28–30	N	pO	NR	Y	dV	S, sl Div
Aploactisoma	1	13–15	12–16	26–29	1	9–13	10–11	I+2	30–33	N	aO	NR	Y	dV	S, st Conv
Bathyaploactis	2	14–15	7–9	21–23	3–4	5–9	10–12	I+2	25–28	Y	pO	R	N	S	W, sl Conv
Cocotropus	11+	12–15	7–11	19–25	1–2	5–9	10–14	I+3	24–28	N	a-mO	NR	Y	s-dV	M, Para
Erisphex	4?	10–13	9–16	21–27	1–2	9–15	11–15	I+2	27–31	Y	O	NR	Y	S	W, p one ridg
Eschmeyer	1	8	13	21	3	8	19–20	I+3	24	Y	P	NR	Y	S	W, sl Conv
Kanekonia	3+	11–13	7–10	20–22	1–2	7–9	13–16	I+2	25–26	N	pO-P	NR	Y	s-dV	W-S, varies
Matsubarichthys	1	6	6	12	2	4	15	I+1	21	N	P	R	N	S	W, ill-defined
Neaploactis	1	12	9–10	21–22	1–2	7–9	12	I+3	26	N	mO	NR	Y	dV	S, Para
Paraploactis	7?	13–15	8–11	22–25	1–2	7–10	13–15	I+3	26–28	N	m-pO	NR	Y	dV	S, st Div
Peristrominous	1	12–13	10–11	22–24	0–2	7–10	14–15	I+3	26–27	N	P	NR	Y	S	S, Div
Prosoproctus	1	12	8	20	2	7	13	I+3	26	N	O	NR	Y	sV	W, Para
Pseudopataecus	1	13–15	14–15	28–29	1	11–13	11	I+3	30	N	A	NR	Y	dV	M, bowed
Ptarmus	2	13–16	7–10	21–23	2	4–7	9–10	I+2	25–30	Y	aO	NR	Y	S	W, p one ridg
Sthenopus	1	12	8–10	20–22	1	7–9	14–15	I+2	26	N	O	NR	Y	S	W, ill-defined
Xenaploactis	3	12–14	7–9	21–22	1	8–10	14–15	I+3	27–28	N	pO	NR	Y	dV	S, varies

Abbreviations: *Y*, present; *N*, absent.

[a] dorsal fin insertion: (*A*) situated anterior to orbit; (*O*) situated above orbit; (*P*) situated posterior to orbit; (*a*) anterior margin; (*m*) middle; (*p*) posterior margin.

[b] gill opening: (*R*) restricted; (*NR*) not restricted.

[c] squamation: (*S*) skin smooth, sometimes with dermal appendages but scales lacking or deeply embedded; (*V*) scales present in the form of velvety prickles; (*s*) sparse; (*d*) dense.

[d] interorbital ridges: (*W*) ridges weakly sculptured or smooth; (*M*) ridges moderately sculptured; (*S*) ridges strongly sculptured; (*Para*) ridges parallel; (*Conv*) ridges convergent; (*Div*) ridges divergent; (*p one ridg*) ridges convergent anteriorly but forming a single ridge posteriorly; (*sl*) slightly; (*st*) strongly.

from South Africa, the Comores and Tanzania, *C. masudai* Matsubara, 1943 from Japan, *C. steinitzi* Eschmeyer & Dor, 1978 from the Red Sea, Andaman Islands, and northern Papua New Guinea, *C. larvatus* Poss & Allen, 1987 from the Marshall, Ryukyu, Great Banda and Christmas islands, and northern Papua New Guinea, *C. keramensis* Imamura & Shinohara, 2003 from Kerama Islands, southern Japan, and the new species from central eastern Australia. The last appears to be a rare cryptic species; type specimens were collected from among heavy cover within a rockpool and boulder seawalls in a highly accessible and reasonably well-collected region of eastern Australia.

Materials and methods

Methods for counts and measurements follow Eschmeyer (1969), except the term lachrymal is substituted for preorbital. The last rays of the dorsal and anal fins appear separate, but are borne on the same pterygiophore as the penultimate, so each pair is counted as one. Vertebral counts were made from radiographs. Measurements were taken using a dial calipers, with the aid of a stereo microscope where necessary. Interorbital width was taken horizontally, across the middle of the orbit. Specimen lengths are Standard Lengths in mm. Where different, values for paratypes follow those of the holotype in parentheses. Meristic and morphometric details for the new taxa are presented in Tables 2 and 3. A brief diagnosis of key features is provided from the material examined of the two species recorded in Australian waters for the first time. Institutional codes follow Leviton *et al.* (1985).

Comparative material examined

Adventor elongatus QM I.26849, 84 mm, Warrior Reefs, Torres Strait, Qld, 9°48'S 142°58'E.

Aploactis aspera QM I.9993, 66 mm, 6–7 mi NE of Caloundra lighthouse, Qld, 26°45'S 153°13'E; QM I.27328, 60 mm, 16 km NE of Double Island Point, Qld, 25°51'S 153°19'E; QM I.29954, 54 mm, NE of Shelburne Bay, Qld, 11°39'S 143°35'E; QM I.33331, 52 mm, E of Curtis Island, Qld, 23°35'S 151°34'E.

Aploactisoma milesii QM I.373, 127 mm, Port Jackson, NSW; QM I.2677, 78 mm, same data; QM I.2678, 72 mm, same data; QM I.22850, 128 mm, Fly Point, Port Stephens, NSW.

Bathyaploactis ornatissima QM I.10697, 45 mm, Off Redcliffe, Moreton Bay, Qld, 24°14'S 153°07'E.

Cocotropus altipinnis AMS I.5132, holotype, 34 mm, Lord Howe Island (vertebral and gill-raker counts provided by Dr Hisashi Imamura, Hokkaido University Museum).

Cocotropus dermacanthus BMNH 1908.3.23.180–181, Seychelles (radiograph only).

Cocotropus larvatus WAM P.29008-001, paratype, 21 mm, Christmas Island, 10°26'S 105°40'E; WAM P.30620-011, 24 mm, Madang, Papua New Guinea, 5°09'S 145°50'E.

Cocotropus monacanthus BMNH 1905.1.7.6, South Africa (radiograph only).

Cocotropus roseus BMNH 1846.11.22, Madras, India; BMNH 1901.12.31.20, Maldives (radiographs only).

Cocotropus steinitzi NTM S.13668-011, 29.7 mm, reef ESE of Gosem Island, Madang, Papua New Guinea.

Erisphex aniarus QM I.28307, 74 mm, NE of Cape

Moreton, Qld, 26°55'S 153°36'E.
Kanekonia florida UMMZ 192040, 3: 27–30 mm, Nagasaki, Japan.
Kanekonia queenslandica QM I.27726, 37 mm, Gulf of Carpentaria, Qld, 10°20.2'S 141°09.7'E.
Neaploactis tridorsalis WAM P.25529-001, holotype, 34 mm, One Tree Island, Qld, 23°30'S 152°00'E.
Paraploactis trachyderma QM I.30298, 105 mm, Polka Point flats, Dunwich, Qld, 27°30'S 153°24'E.
Peristrominous dolosus QM I.23553, 58.5 mm, west of Watt Reef, Qld, 18°42.5'S 147°03.2'E.
Ptarmus gallus BMNH 1960.3.15.1724–1725, 2: 25–39 mm, Knor Shinab, Sudan, Red Sea; BMNH 1960.3.15.1726–1728, 3: 13.5–30.5 mm, Khor Inkeifail, Sudan, Red Sea.

Pseudopataecus n.gen.

Type species. *Pseudopataecus taenianotus* n.sp.

Diagnosis. Dorsal fin XIII–XV, 14–15; anal fin I, 11–13; pectoral fin 11; pelvic fin I, 3; all fin rays unbranched. Dorsal fin high, with membrane not or only slightly incised, anterior portion distinctly raised, originating on cranium almost one eye diameter before anterior margin of eye. Pelvic fins long and slender, reaching about two-thirds distance to anus. Head and body highly compressed, body width 6.4–6.9 in SL; frontal bone with non-prominent laterally-bowed ridges, a shallow fleshy depression in their interspace; fleshy cirri densely arranged on margin and ventral surface of mandible; anterior tip of isthmus free; modified scales densely arranged on head and body; bands of minute villiform teeth in jaws and on vomer; no teeth on palatines; vertebrae 30.

Discussion. *Pseudopataecus* can readily be distinguished from all other aploactinid fishes in having a combination of high numbers of dorsal-fin rays, anal-fin rays and vertebrae, markedly compressed head and body, well-developed velvety scales, and shallow fleshy depression present between the laterally-bowed fleshy frontal ridges (Table 1). It has the dorsal fin inserted far forward (almost one orbital diameter before a vertical from anterior margin of eye) and containing 28 or 29 elements, and 30 vertebrae. Of all known aploactinids, only the monotypic *Aploactis* Temminck & Schlegel, 1843 and *Aploactisoma* Castelnau, 1872 have a total of both 28 or more dorsal fin elements and 29 or more vertebrae. Species of the latter are easily distinguished from this genus by their more robust head and body, more prominent and sculptured cranial ridges (interorbital ridges slightly divergent in *Aploactis*, strongly convergent in *Aploactisoma*), more posteriorly inserted dorsal fin (above posterior margin of eye in *Aploactis*, anterior margin of eye or just before in *Aploactisoma*), much shorter dorsal- and anal-fin rays (longest dorsal- and anal-fin rays 1.7–2.1 and 2.0–2.5 in *Aploactis*, 1.8–2.3 and 2.0–2.5 in *Aploactisoma*, versus 1.2–1.4 and 1.6–1.8 in head length respectively in *Pseudopataecus*), and two versus three pelvic-fin rays. Some species of *Erisphex* Jordan & Starks, 1904 may have up to 27 dorsal fin elements and 31 vertebrae (Poss, 1999), however members of this genus have a considerably more robust head and body, pungent lachrymal, preopercular and dorsal-fin spines, smooth scaleless skin, and only two pelvic fin rays. The broadly defined *Cocotropus* Kaup, 1858 is superficially similar to *Pseudopataecus*, but has parallel interorbital ridges, with no more than a narrow shallow groove within the interspace, 25 or fewer dorsal fin elements including 11 or fewer rays, 11 or fewer anal-fin ray elements, 9–12 lateral-line tubes (versus 13–14), and 28 or fewer vertebrae. The frontal bones of *Paraploactis* Bleeker, 1865 have prominent ridges diverging posteriorly to form a bony pyriform depression. They are more elaborately sculptured, not covered in skin, and their depression deeper and more angular than in *Pseudopataecus*. *Paraploactis* also has no more than 25 dorsal fin elements and 28 vertebrae (Poss & Eschmeyer, 1978). *Ptarmus* Smith, 1947 shares a notably compressed head and body and forward-placed dorsal-fin insertion, but more closely resembles the tetrarogin scorpaenids, with smooth, ill-defined head ridges, a larger mouth, more prominent snout, pungent lachrymal, preopercular, and dorsal-, anal- and pelvic-fin spines, significantly fewer dorsal-, anal- and pectoral-fin rays, and no scales other than in the lateral line (densely arranged in *Pseudopataecus*).

Pseudopataecus taenianotus n.sp.

Longfin velvetfish

Figs. 3a,b, 1; Table 2

Type material. HOLOTYPE: QM I.33192, 82 mm, WSW of Lady Musgrave Island, 23°57.21'S 152°13.32'E, scallop trawl, 37 m, Qld Fisheries Service, 4 October 2000. PARATYPES: AMS I.42652-001, 75 mm, NE of Burnett Heads, 24°39.028'S 152°41.438'E, scallop trawl, 25 m, Qld Fisheries Service, 12 October 2002; QM I.30723, 93 mm, 15 mi NE of Burnett Heads, 24°38'S 152°36'E, scallop trawl, G. Lowe, 27 January 1982; QM I.33193, 80 mm, NE of Burnett Heads, 24°36.52'S 152°31.91'E, scallop trawl, 20 m, Qld Fisheries Service, 9 October 2000; QM I.33850, 93 mm, NE of Rodds Peninsula, 23°51.44'S 151°48.27'E, scallop trawl, 36 m, Qld Fisheries Service, 11 December 2002; QM I.33944, 108 mm, W of Bunker Group, 23°48.1'S 151°56.50'E, scallop trawl, 40 m, Qld Fisheries Service, 10 October 2002; QM I.33945, 97.5 mm, NE of Keppell Islands, 22°59.01'S 151°17.37'E, scallop trawl, 40 m, Qld Fisheries Service, 14 October 2002.

Non-type material. QM I.33941, 2: 81.5–82 mm, NW of Sandy Cape, 24°30.87'S 152°53.62'E, scallop trawl, 35 m, Qld Fisheries Service, 13 October 2002; QM I.33942, 2: 74–107 mm, NE of Burnett Heads, 24°39.33'S 152°43.03'E, scallop trawl, 28 m, Qld Fisheries Service, 12 October 2002; QM I.33943, 97 mm, E of Round Hill Head, 24°08.24'S 152°10.26'E, scallop trawl, 33–37 m, Qld Fisheries Service, 14 October 2002.

Diagnosis. See generic diagnosis.

Description. Head 3.3 (3.1–3.3) in SL, markedly compressed and covered with modified scales ending in spinous points; scales less dense on snout and interorbital space. Dorsal profile of head convex, ascending steeply, obscured by loose skin at base of extremely anteriorly inserted dorsal fin, inclined dorsoposteriorly about 60° from horizontal. Eye 3.8 (3.8–4.6) in head. Lachrymal spines connected at base, with broad blunt points, first directed anteroventrally over maxilla, second slightly longer and

Table 2. Selected meristic and morphological values for type specimens of *Pseudopataecus taenianotus* (measurements as percentage of standard length).

	holotype	paratypes					
	QM I.33192	AMS I.42652-001	QM I.33193	QM I.33850	QM I.30723	QM I.33945	QM I.33944
standard length	82	75	80	91.5	93	97.5	108
dorsal-fin rays	XIV/14	XIII/15	XIV/14	XIV/15	XIV/15	XIV/14	XV/14
anal-fin rays	i/12	i/11	i/12	i/11	i/11	i/13	i/12
pectoral-fin rays	11,11	11,11	11,11	11,11	11,11	11,11	11,11
caudal-fin rays	12	13	13	12	13	13	13
gill-rakers	1+6,1+5	0+5,1+5	1+6,1+5	0+5,0+5	1+4,1+4	1+6,1+4	1+6,1+5
lateral-line tubes	14	13	13	14	14	13	13
vertebrae	30	—	30	—	30	—	—
pelvic-fin rays	i/3	i/3	i/3	i/3	i/3	i/3	i/3
head length	30.6	31.7	32.4	31.4	31.5	31.4	32.4
snout length	7.4	8.0	8.0	7.4	8.1	8.0	7.9
orbit diameter	8.0	7.2	8.1	7.4	8.0	6.9	7.4
interorbital width	8.0	8.3	7.5	7.8	7.7	7.4	7.5
jaw length	9.9	10.4	9.3	10.3	10.5	9.8	9.5
postorbital length	16.4	16.9	17.4	17.4	17.2	16.7	17.0
body depth	33.3	36.3	33.9	35.4	34.6	35.0	35.3
body width	14.5	15.7	15.0	14.4	—	15.4	15.6
predorsal length	9.1	9.7	8.9	9.0	9.6	9.4	10.0
dorsal-fin base (to last ray)	92.3	92.0	91.0	92.6	93.1	91.2	92.3
dorsal-base (to membrane)	99.4	98.0	98.8	98.6	100.0	98.1	96.7
anal-fin base	31.5	37.3	33.6	33.2	30.3	35.9	34.1
caudal-fin length	30.6	30.7	27.6	29.5	28.7	26.8	26.7
pectoral-fin length	33.5	34.1	33.8	31.7	31.3	32.2	31.4
pelvic-fin length	18.5	19.3	18.8	15.3	17.4	17.2	17.8
first dorsal-fin spine length	31.6	31.2	32.3	30.5	30.4	26.7	27.6
second dorsal-fin spine length	33.3	34.1	33.3	32.3	32.1	31.4	31.2
third dorsal-fin spine length	32.7	32.7	32.4	30.1	28.8	30.6	30.4
fourth dorsal-fin spine length	26.8	27.3	27.6	27.7	24.4	25.7	26.5
fifth dorsal-fin spine length	21.3	22.7	22.3	21.7	20.1	21.3	21.0
penultimate dorsal-fin spine length	17.6	16.9	16.6	17.6	14.6	16.6	16.3
last dorsal-fin spine length	17.4	17.1	16.6	17.7	14.8	—	16.6
longest dorsal-fin ray	24.5	25.5	23.9	22.6	24.9	23.1	22.2
first anal-fin spine length	6.5	4.7	5.8	5.1	5.2	4.2	5.7
longest anal ray	18.7	20.0	18.8	17.0	18.6	18.5	17.5
least depth of caudal peduncle	9.9	10.7	9.9	9.8	10.8	9.4	9.4

narrower, directed posteriorly just below the horizontal. Small blunt bony knob-like spine at base of first lachrymal spine. Suborbital ridge with 4 or 5 low knob-like spines, covered with skin, anterior two difficult to detect. Interorbital ridges not prominent, covered with skin, laterally-bowed at midlength, then gently converging posteriorly to meet a flat transverse bony process anterior to base of first dorsal spine; ridges forming a shallow fleshy depression in their interspace (Fig. 1). Tip of rostral cartilage from ascending premaxillary processes evident by a low bump in fleshy depression. Simple to poorly branched cirrus anteriorly at inside edge of each ridge and posteriorly at the outside edge of each ridge. No spines on nasals. Anterior nostril a simple tab-like tube midway between eye and tip of snout. Posterior nostril just anterior to middle of eye, a less prominent open tube with anterior margin raised. Fleshy, slightly raised pores at snout tip, middle of lower margin of lachrymal, and at upper and lower margins of preopercle. Preopercle with 5 blunt spines; dorsalmost largest, projecting laterally and posterodorsally; others with broader tips, directed perpendicular to curve of preopercular margin, gradually decreasing in size; lower 3 each armed with a poorly branched cirrus. Anterior edge of interopercle with 2 similar cirri. Operculum with 2 ridges; lower horizontal, reaching opercular margin; upper inclined about 45°to the horizontal, not reaching opercular margin; neither with spinous tips. Dorsal margin of operculum scalloped and steeply inclined dorsoposteriorly; opercular tip narrow, directed toward seventh or eighth dorsal spine. Supraocular, sphenotic, pterotic, lower posttemporal and supracleithral spines forming similar-sized blunt ridges; less prominent and covered with thicker skin in larger paratypes. Cleithrum without spine. Ventral surface of lower jaw with numerous branched and unbranched cirri, those at posterior of outer row longest, up to about half eye diameter; those anterior and in inner rows mostly shorter and unbranched; more papillose and tufted anteriorly in larger paratypes. Prominent pores ventrally at middle and posterior of mandibles. Both lips papillose, but papillae more cirri-like anteriorly, those at tip of lower lip particularly well developed. Maxilla broad, scaled, with a well-developed cirrus near lower margin; rear margin very slightly curved, extending just beyond a vertical from anterior margin of eye. Both jaws with broad uniform band of minute firm conical teeth. Similar small but well-developed teeth in a crescentic band on the vomer, band projecting anteriorly and widest medially. No teeth on

Table 3. Selected meristic and morphological values for type specimens of *Cocotropus microps* (measurements as percentage of standard length).

	holotype	paratypes	
	QM I.31134	AMS I.41877-001	AMS I.41266-014
standard length	39	24	18
dorsal-fin rays	XII/7	XII/7	XII/7
anal-fin rays	ii/5	ii/5	ii/5
pectoral-fin rays	11,11	10,10	10,11
caudal-fin rays	16	16	17
gill-rakers	1+5	1+4	2+5
lateral-line tubes	11	11	11
vertebrae	24	—	—
pelvic-fin rays	i/3	i/3	i/3
head length	36.2	35.8	38.9
snout length	12.3	11.3	11.1
orbit diameter	8.2	7.9	9.4
interorbital width	7.9	8.8	9.4
jaw length	16.2	16.3	14.4
postorbital length	18.5	15.8	17.8
body depth	36.9	36.7	34.4
body width	13.6	13.8	14.4
predorsal length	19.7	23.8	23.3
dorsal-fin base (to last ray)	82.1	76.7	73.3
dorsal-fin base (to membrane)	84.1	80.4	75.0
anal-fin base	26.7	26.3	25.6
caudal-fin length	23.8	27.5	27.8
pectoral-fin length	32.3	31.7	33.3
pelvic-fin length	18.2	16.7	16.1
first dorsal-fin spine length	18.2	17.5	18.3
second dorsal-fin spine length	21.8	21.3	21.7
third dorsal-fin spine length	21.3	21.3	21.7
fourth dorsal-fin spine length	18.2	17.1	16.1
fifth dorsal-fin spine length	14.4	12.9	12.2
penultimate dorsal-fin spine length	9.5	10.8	9.4
last dorsal-fin spine length	10.3	12.1	10.6
longest dorsal-fin ray	24.1	22.5	22.8
first anal-fin spine length	7.2	6.7	6.1
second anal-fin spine length	9.7	10.0	8.9
longest anal-fin ray	20.5	19.2	20.0
least depth caudal peduncle	13.3	12.9	13.3

palatines. Tongue stout and rounded. Gill rakers short knobs, 1 (0–1) on upper limb, 5 on right side and 6 on left side of lower limb in holotype (4–6), total 6 on right side and 7 on left side of first arch (5–7); when present the single raker on upper arch very poorly developed. Spacing of rakers somewhat irregular, usually a short gap devoid of rakers below and adjacent to angle of arch. No slit behind posterior hemibranch. Branchiostegal membranes not fused to isthmus. Isthmus with fleshy extension anteriorly, slightly expanded, its free tip longer than wide.

Body markedly compressed, depth 3.0 (2.8–3.0) in SL, width 6.9 (6.4–6.9) in SL, densely covered with modified scales. Lateral line with 14 (13–14) tubes, gently sloping posteroventrally to the midlateral, then continuing in a generally straight course to the caudal base. Tubed scales mostly armed with a small cirrus; last scale on the caudal

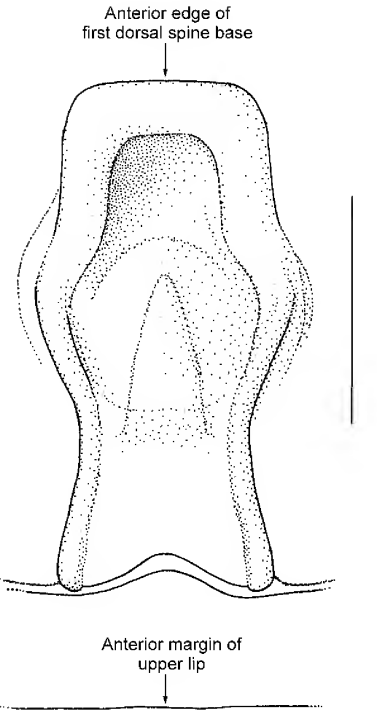

Fig. 1. Frontal view of interorbital region of *Pseudopataecus taenianotus*, showing laterally-bowed ridges and shallow fleshy depression. Scale = 3 mm.

base. Dorsal fin originating slightly more than two-thirds of eye diameter before anterior margin of eye. Second dorsal-fin spine longest, first or third next longest, spines decrease in length posteriorly to sixth or seventh spine, then slightly increase at seventh or eighth, with ninth to fourteenth spines approximately equal in length. Dorsal-fin membrane not or very weakly incised, membrane from last dorsal-fin ray adnate to upper corner of caudal-fin base. Pectoral fin rounded, tips of rays protruding from membrane, fourth or fifth ray longest, reaching vertical between anus and first anal-fin spine. Pelvic fin relatively long and slender, 1.5 (1.5–1.7) in distance from their base to anus; with flexible spine and 3 rays; first ray subequal to second, third or innermost ray rudimentary and much shorter; longest pelvic-fin ray subequal to fifth dorsal-fin spine; pelvic-fin membrane not adnate to body. Anal fin with single short spine, not protruding from membrane; rays gradually increasing in length to ninth or tenth, last two shorter; membranes distinctly incised. Caudal fin rounded, with 12 (12–13) rays; the latter protruding slightly from membrane. All fin-rays unbranched. Vertebrae 30.

Preserved coloration (in alcohol). Pale grey-brown with irregular fine darker brown mottlings and diffuse blotches on head and body. Two round dark brown blotches, slightly larger than eye, on upper body just reaching lateral line, first above middle of pectoral fin and second below last dorsal-fin rays, fading in preservative. Dorsal and pectoral fins with fine dusky mottling, darkest on outer half of fin. Anterior elevated portion of dorsal fin with slightly more defined pattern of wavy markings. Anterior edge of first dorsal-fin spine with irregular transverse dark brown bars. Caudal, anal and pelvic fins with more uniformly distributed dusky mottling. Tips of all fin rays pale. A narrow transparent area of membrane at upper and lower posterior margin of caudal fin.

Ventral side of head, breast and belly pale.

Live coloration. Fresh specimens dull red to chocolate-brown in ground coloration, with breast and belly cream to creamy yellow.

Etymology. *Pseudopataecus* from the Greek pseudo, "false", in reference to the superficial but false likeness to the pataecid genus *Pataecus*. The species epithet *taenianotus* refers to its long ribbon-like dorsal fin.

Distribution. Known from the types and five other specimens, all taken between 20 and 40 m depth by scallop trawl offshore inside the Capricorn-Bunker Group (22°59.01' to 24°39.33'S), in southern Queensland, Australia. Trawls were carried out over predominantly sandy bottom, with some scattered shell and rubble. Brown algae *Padina* sp. and smaller amounts of rubble and the seagrasses *Halophila ovalis* and *H. spinulosa*, were recorded in the catch with one of the specimens.

Discussion. *Pseudopataecus taenianotus* appears most closely related to *Aploactisoma milesii* (Richardson, 1850), but differs in having much less prominent and sculptured cranial ridges, interorbital ridges laterally-bowed versus strongly convergent, more compressed head and body (body width 6.4–6.9 versus 4.3–5.7 in SL, interorbital width 3.8–4.3 versus 3.5–3.8 in head length), fin rays longer and less robust (longest dorsal-fin ray 1.2–1.4 versus 1.8–2.3, longest anal-fin ray 1.6–1.8 versus 2.0–2.5 in head length), velvety scales less papillose and robust, and three versus two pelvic-fin rays. The differences between these two species are clearly accentuated with age. There is little change in proportions with growth in *P. taenianotus*, but *A. milesii* becomes increasingly robust with age.

There are strong anecdotal and survey-based indications that the range of this species is patchy and limited broadly to that documented here. A photograph of *Pseudopataecus taenianotus* presented to commercial scallop fishermen from the Bundaberg region was promptly identified as a species occasionally captured from the northern Hervey Bay–Bundaberg region (c. 23°30'–24°50'S), "on grounds rich in algae, sponges and various invertebrates". They reported that it was "absent on scallop grounds to the north where the substrate is generally much cleaner" (lacking in rubble, plant and sessile invertebrate growth). It is most likely that the fishermens' reports pertain to *P. taenianotus*, rather than another scorpaeniform species. The pataecid, *Pataecus fronto* Richardson, is superficially similar in appearance, however the latter has a more southerly distribution (northernmost record is off Alexandra Headland, 26°40'S Johnson, 1999: 728), lacks pelvic fins, and has a more uniform and brighter reddish coloration. The scorpaenid, *Ablabys taenianotus* (Cuvier) has a similar compressed appearance and long-based dorsal fin, however it has smooth cycloid scales (rather than dense velvety scales), and obviously pungent spines to the dorsal and anal fins. No other known aploactinid fish from Australian tropical waters is easily confused with *P. taenianotus*. Specimens of *P. taenianotus* have also failed to feature in numerous museum collections and research surveys using trawl gear in similar depths elsewhere throughout eastern Australia. Most of the twelve known specimens have been collected in a relatively small patch NE of Burnett Heads. This is despite intensive collecting by long-term monitoring and scallop bycatch research surveys throughout the region. It seems likely that the occurrence of this species is correlated with bottom structure, flora or invertebrate communities specific to the area. It could potentially be threatened by concentrated fishing effort within its narrow range.

Cocotropus microps n.sp.

Patchwork velvetfish

Fig. 3c,d; Table 3

Cocotropus sp.—Johnson, 1999: 728, fig. 2E.

Type material. HOLOTYPE: QM I.31134, 39 mm, Southport seawall, about 150 m west of entrance, 27°56'S 153°26'E, 2–4 m, J. Johnson, 29 May 1998. PARATYPES: AMS I.41266-014, 18 mm, Ballina, Richmond River, south wall c. 100 m west of entrance, 28°52.55'S 153°35.14'E, 0–4 m, M. McGrouther & A. Gill, 20 March 2002; AMS I.41877-001, 24 mm, Spooky Point, Angourie, large rockpool east of "Blue Pool", 29°28.73'S 153°21.83'E, 0–1.5 m, M. McGrouther, A. Gill & J. Pogonoski, 12 December 2002.

Non-type material. AMS I.41265-098, 2: 15.5–16.1 mm, Iron Peg Point, channel on southern side, off Rocky Point Road, 28°49.36'S 153°36.36'E, 0–1.5 m, A. Gill, K. Parkinson, M. McGrouther, 20 March 2002; AMS I.40868-024, 19.7 mm, Chowder Bay, Sydney Harbour, end of fuel wharf on east side, 33°50.5'S 151°15.18'E, 14.4 m, AMS Team, 24 May 2001.

Diagnosis. Dorsal XII, 7; anal II, 5; pectoral 10–11; pelvic I, 3; caudal 16–17; all fin rays unbranched; vertebrae 24. Dorsal fin with anterior, middle and posterior portions notably elevated, first interspace moderately scalloped, second deeply notched; dorsal fin membrane connected posteriorly to caudal peduncle; head, body and fins densely covered with scales, modified to form velvety prickles; a small fleshy extension on the anterior of the isthmus; frontal ridges parallel on interorbital; body and fins variously marked with pale or white blotches, or small irregular spots.

Description. Head 2.8 (2.6–2.8) in SL, moderately compressed and covered with modified scales forming velvety prickles; the latter prominent on operculum, preorbital, snout and lower surface of mandible, sparse on much of postorbital, in groove between frontal ridges and absent around nostrils. Dorsal profile of head slightly concave overall between snout tip and insertion of dorsal fin; small bump at tip of nasals, then straight to base of first dorsal spine; ascending at about 50° from horizontal. Eye 4.4 (4.1–4.5) in head. Lachrymal large, movable, with two short knob-like spines ventrally, followed by large blunt spine directed posteriorly and reaching almost to vertical from rear margin of eye. Very small blunt knob antero-dorsally of first lachrymal spine base, and larger knob-like spine, subequal to second lachrymal spine, above mid-distance between first and second lachrymal spines. Suborbital ridge with two spines, first firm, bluntly pointed, below anterior margin of orbit; second much larger, more knob-like, centred below rear margin of pupil. Interorbital ridges distinct, but not strongly sculptured, parallel from their base at posterior tip of nasals almost to their termination

at base of first dorsal spine, where they are slightly flared laterally; shallow groove in their interspace. No spines on nasals. Anterior nostril a simple tube, slightly nearer tip of snout than anterior margin of eye. Posterior nostril less prominent, an open pore with slightly raised rim, situated just anterior to horizontal from upper edge of pupil. Slightly raised pores at upper base of lachrymal, interorbital above posterior nostril, and preopercle below fourth preopercular spine. Preopercle with 4 robust blunt spines; dorsalmost largest, projecting laterally and slightly above the horizontal; others with broader tips, directed perpendicular to curve of preopercular margin, gradually reducing in length; all densely armed with well-developed knobby prickles. Opercular ridges poorly defined, surface of operculum obscured by large knobby prickles. Operculum with 2 spines, upper a low blunt point, just anterior to rear tip, second slightly smaller, short distance below on opercular margin. Dorsal tip of operculum a small free flap, received by well-developed V-shaped pit, the point of which is directed toward the sixth or seventh dorsal spine. Cleithrum with robust blunt spine. Upper and lower post-temporal spines large, broad-based, blunt and bulbous, the former not forming distinct point, latter with its tip hooked back posterolaterally; supracleithral spine posterior to and slightly below lower post-temporal, much smaller and more slender, bluntly pointed and directed toward about sixth dorsal spine. No other prominent spines on head. Ventral surface of lower jaw densely covered with numerous small knobby papillae. Each side of jaw, adjacent to ventral edge of lower lip, with 3 stubby papillae subequal in length to pupil diameter, each also covered with small knobby papillae. Two similar stubby papillae on medial edge of dentary, and one on rear of dentary posteroventral to rear tip of maxillae. Four pores along each side of dentary and a pair of pores at posterior of symphysis. Ventral edge of dentary projecting medially. Both lips densely covered in uniform knobby papillae. Maxilla broad, scaled, with a short stubby papillae just anterior to rear tip; its rear margin slightly rounded, extending to vertical through middle of eye. Both jaws with teeth in broad villiform bands, widest anteriorly, with at least 12 tooth rows at widest point, no enlarged teeth. Vomer with narrow band of minute teeth. Palatines edentulous. Tongue stout and broadly rounded. Gill rakers as low knobs, not evenly spaced, 1 (1–2) on upper limb and 5 (4–5) on lower limb of first arch. No slit behind posterior hemibranch. Branchiostegal membranes not fused to isthmus. Isthmus with fleshy extension anteriorly, slightly expanded, its free tip slightly longer than wide.

Body moderately compressed, depth 2.7 (2.7–2.9) in SL, width 7.4 (6.9–7.4) in SL, densely covered with modified scales ending in spinous points. Lateral line with 11 tubes, gently sloping posteroventrally to the midlateral, then continuing in a generally straight course to the caudal base. Tubed scales enlarged, but not armed with cirri; last scale on the caudal base. Vertebrae 24.

Dorsal fin with anterior, middle and posterior portions notably elevated; first interspace shallowly scalloped, second deeply notched. First dorsal-fin spine insertion over anterior third of eye in holotype, to posterior fourth of eye in juvenile paratype. Dorsal-fin spines strong, rigid, but not pungent; second longest, gradually decreasing in length to fifth; sixth and seventh abruptly longer, gradually shorter to the eleventh; twelfth slightly longer. First dorsal-fin ray abruptly longer than last spine, 1.7 (1.5–1.7) times its length; fourth ray longest. First 4 dorsal-fin rays with distal tips strongly curved posteriorly. Dorsal-fin membrane weakly incised, connected posteriorly to caudal peduncle less than one pupil diameter anterior to upper caudal-fin base. Anal fin with 2 soft flexible spines, first 1.4 (1.4–1.5) in length of second, second 1.6 in length of first segmented ray; fourth anal-fin ray longest; first 4 rays with distal tips strongly curved posteriorly; membranes moderately incised. Caudal fin rounded, with 16 (16–17) rays, the rays not protruding from membrane. Pectoral fin rounded, thick and fleshy, tips of median rays protruding from membrane, fourth or fifth ray longest, reaching a vertical from base of last dorsal-fin spine when adpressed. Pelvic fins with a firm but non-pungent spine and 3 fairly robust rays, second ray easily the longest, third or innermost ray shortest; longest pelvic-fin ray equal in length to fourth dorsal-fin spine, reaching less than half distance to anus; pelvic-fin membrane not adnate to body. All fin rays unbranched; most fin elements and membranes variously covered with scales, modified to form velvety prickles.

Live coloration. Holotype mostly dark greyish brown on head and body, with prominent mottled patchwork of yellowish cream on body. Dorsal fin with splotches of dark greyish brown on mainly yellowish cream background, with darker areas mainly centred on elevated portions of fin, and pale areas containing some fine dark flecking. Anal fin not mottled, darker brown than remainder of body, tips of rays paler than remainder of fin. Pelvic fins light brown, with membranes slightly darker than rays. Pectoral fins mostly light brown, but with broad dusky marginal band, and narrow pale edge, including tips of individual rays. Caudal fin with similar pattern to dorsal, but with distal half of fin containing all the mottling and basal half uniformly pale. One paratype (18 mm juvenile) uniformly dusky, except for individual small pale blotches at anus, inner and outer pectoral bases, and pectoral and caudal fins. Another paratype (24 mm juvenile) similarly dusky, caudal fin with two pale blotches at its margin, but with only four very small, more inconspicuous individual white spots situated dorsally on inner pectoral fin bases, just above centre of lateral line on right side, and on anus.

Etymology. The specific name *microps* refers to the small, inconspicuous eyes.

Distribution. Known from six specimens collected in sub-tropical eastern Australia, between Southport, Queensland, and Sydney Harbour, New South Wales, in 0–14.4 m depth, among rocky substrate. Another specimen, collected in 15 m among rocky reef with some coral growth at Cook Island, New South Wales (28°12'S 153°35'E), was unavailable for this study.

Discussion. *Cocotropus microps* further expands the somewhat elastic concept of this genus. It is referred to the genus on the basis of its meristics, parallel interorbital ridges, presence of a fleshy extension to the isthmus, continuous dorsal fin, and type of velvety scales. This species differs most notably from its congeners in having lower dorsal- and anal-fin ray counts (XII, 7 versus XII–XV, 8–11 and II, 5 versus I–II, 6–9 respectively); dorsal fin with three distinctly elevated sections, at the front, centre and rear portions of the fin; and in coloration. Its pectoral-fin ray count

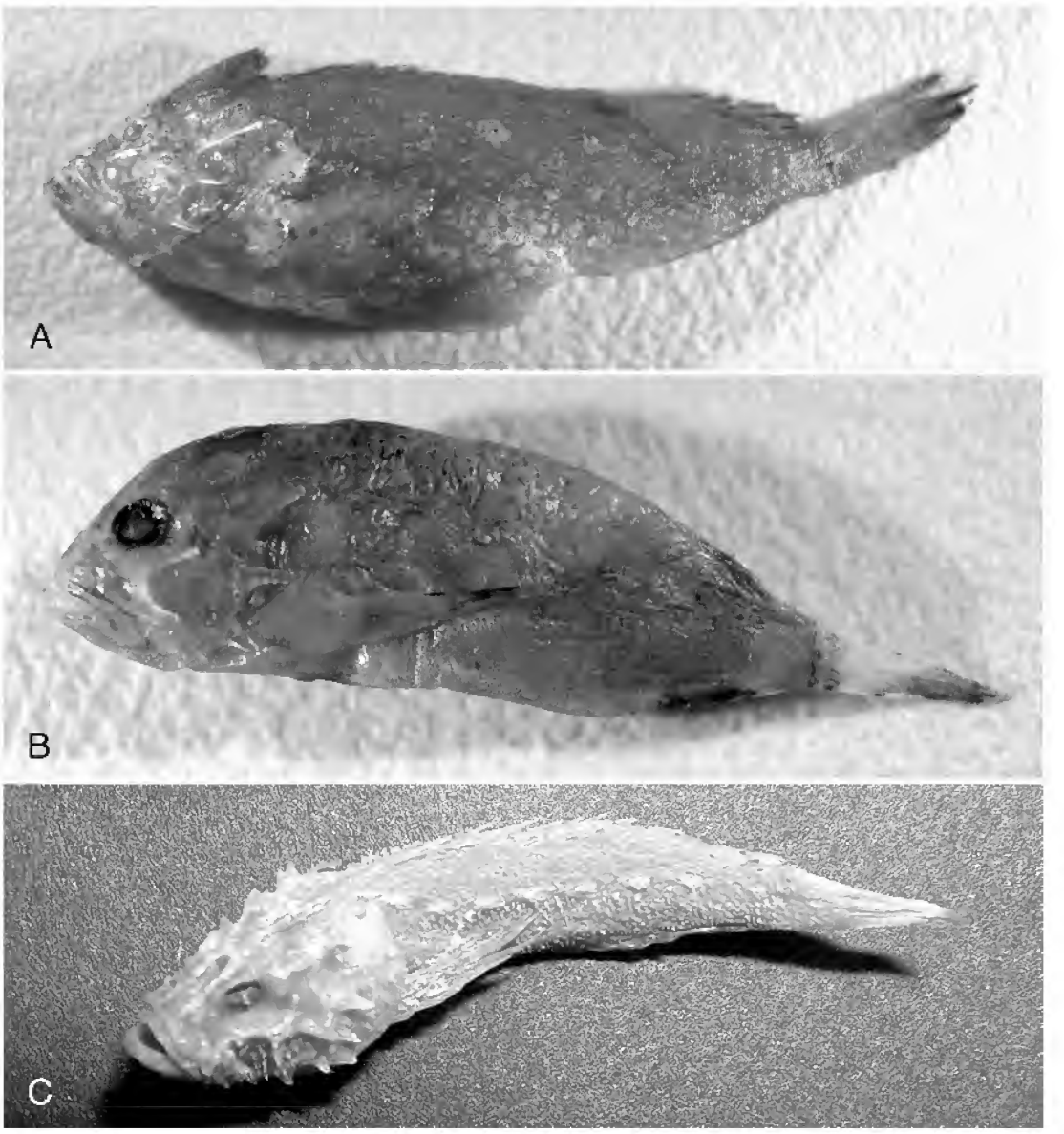

Fig. 2. New records of aploactinid fishes from Australian waters. (*a*) *Acanthosphex leurynnis*, WAM P.31618-001, 25.7 mm; (*b*) *A. leurynnis*, QM I.29200, 17 mm; (*c*) *Xenaploactis cautes*, AMS I.24800-004, 21.9 mm.

(10–11) is low for the genus (only *C. dermacanthus* with 11–13 and *C. echinatus* with 11 overlap), its caudal-fin ray count (16–17) is high (other species 11–16), and its vertebral count is the lowest known for the genus (24 versus 25–28).

New records for Australia

Two species of velvetfishes are recorded in Australian waters for the first time. A diagnosis is provided for the voucher material.

Acanthosphex leurynnis (Jordan & Seale, 1905), previously known from Hong Kong, Gulf of Thailand, southeast India, Indonesia and eastern Papua New Guinea (Vidthayanon & Bettencourt, 1988; Eschmeyer, 1998; Poss, 2000), is reported from the Cumberland Group in tropical eastern Australia, Arafura Sea, NE of Goulburn Island, Northern Territory, and north of Perth, southern Western Australia (Fig. 2a,b).

Diagnosis. Dorsal fin III, IX–X, 6–8; anal fin I–II, 6; pectoral fin 9–10, pelvic fins I, 2; lateral-line tubes 9; gill openings restricted to sides of head; preorbital armed with 2 very large posteriorly directed blunt spines, extending well beyond posterior margin of eye; preoperculum with 4 large spines, upper largest, spines gradually decreasing in length ventrally.

Material examined. QM I.29200, 17 mm SL, Repulse Bay, 20°36'S 148°44'E, beam trawl, Qld Fisheries Service, 23 March 1994; QM I.23965, 2: 13.5–14.1 mm SL, Whitsunday Island, c. 20°15'S 148°56'E, seagrass trawl, Qld Fisheries Service, 29 March 1987; WAM P.31618-001, 25.7 mm SL, c. 1 km off Whitfords Beach, WA, c. 31°48'S 115°43'E, 8 m, trawl, WA Fisheries; NTM S.11899-012, 9.6 mm SL, Arafura Sea, NE of Goulburn Island, Northern Territory, 10°38'S 134°00'E, 60 m, trawl, NT Fisheries, 25 April 1986.

Xenaploactis cautes Poss & Eschmeyer, 1980, previously known only from the Andaman Sea and Gulf of Thailand (Poss & Eschmeyer, 1980) is reported from off northwestern

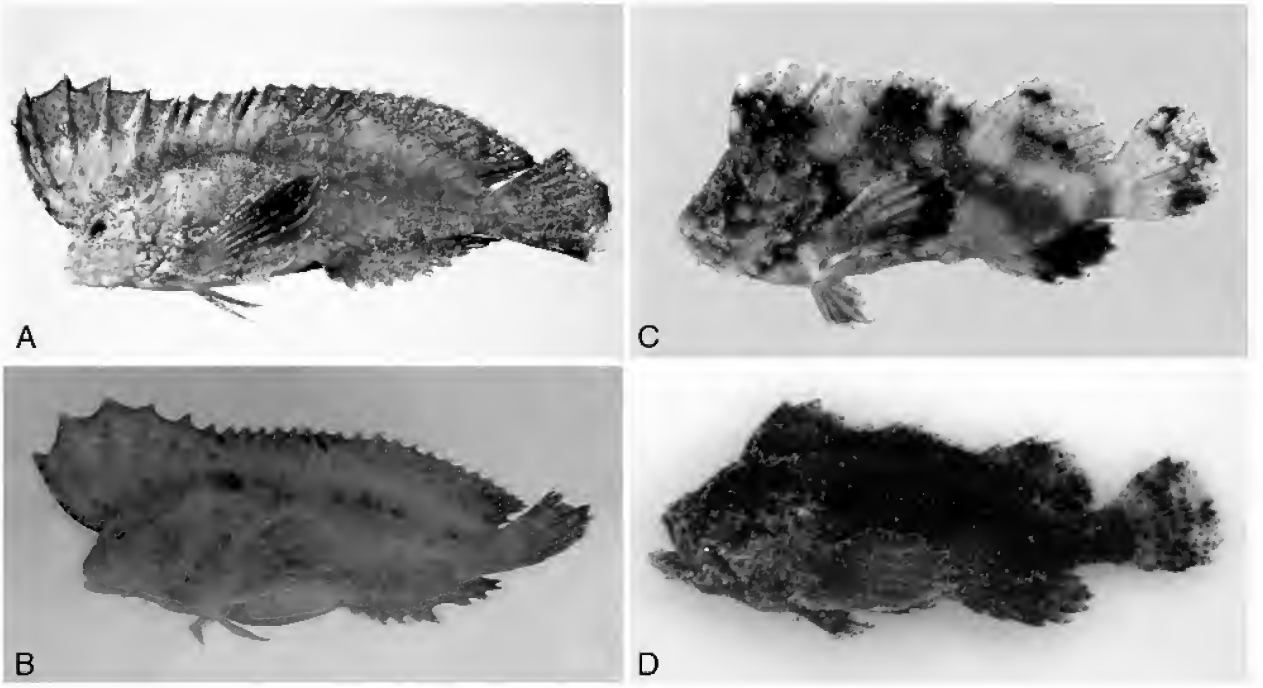

Fig. 3. Type specimens of new aploactinid fishes. (*a*) *Pseudopataecus taenianotus*, holotype, QM I.33192, 82 mm; (*b*) *P. taenianotus*, paratype, QM I.33944, 108 mm; (*c*) *Cocotropus microps*, holotype, QM I.31134, 39 mm; (*d*) *C. microps*, paratype, AMS I.41877-001, 24 mm.

Australia (Fig. 2c) and the Gulf of Carpentaria, Queensland. Based on material from the Northern Territory Museum, the record of *Xenaploactis* sp. from the Arafura Sea, northern Australia as reported by Russell & Houston (1989) is erroneous, and confirmed (above) as a record of *Acanthosphex leurynnis* (Jordan & Seale).

Diagnosis. Dorsal fin III, XI, 7–8; anal fin I, 8; pectoral fin 14–15, pelvic fins I, 3; lateral-line tubes 10; gill-rakers 2–3+7; body depth 25.6–30.7% SL; interorbital ridges almost parallel.

Material examined. AMS I.24800-004, 21.9 mm, Northwest Shelf, 72 nautical miles NNW of Dampier, WA, 19°29'S 116°29'E, 110 m, trawl, S.J. Jenkins, 26 October 1983; QM I.34890, 28.7 mm, Gulf of Carpentaria, Qld, 11°11'S 139°26.4'E, 50 m, dredge, J. Johnson, 28 November 1991.

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A New Triggerfish of the Genus *Abalistes* (Tetraodontiformes: Balistidae) from the Western Pacific

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ABSTRACT. A new species of triggerfish, *Abalistes filamentosus* is described on the basis of 17 specimens collected at depths from 61 to 180 m in Japan, the Northwest Shelf of Australia, and the Timor Sea. It differs from the congener, *A. stellatus* (Anonymous, 1798), by having filamentous upper and lower caudal-fin rays, 3–4 longitudinal grooves on the cheek, and by lacking yellow/pale blue spots and yellow reticulations on the body. The new species is not sexually dimorphic. The authorship of *Abalistes stellatus* is clarified.

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Triggerfishes of the genus *Abalistes* Jordan & Seale, 1906, are widely distributed in shallow waters in tropical and subtropical regions of the Indo-west Pacific and are commercially important in countries in southeast Asia (Matsuura, 2001). *Abalistes* is clearly separated from other members of the family Balistidae by the following combination of characters: enlarged osseous scales behind gill opening; a deep groove before eye; caudal peduncle depressed, wider than deep; first dorsal fin with 3 prominent spines; frontal greatly expanded posteriorly beyond level of posterior edge of posttemporal, forming round posterodorsal surface of cranium (Matsuura, 1979, 1980). The genus has long been considered to include only one species, *Abalistes stellatus* (Anonymous, 1798). While examining triggerfish specimens collected from the Ryukyu Islands, we found two forms of *Abalistes*: one having filamentous caudal-fin rays and 3–4 longitudinal grooves on the cheek but lacking prominent yellow/pale blue spots and yellow reticulations on the body, and the other lacking filamentous caudal-fin rays and longitudinal grooves on the cheek, but having a colourful body with many yellow/pale blue spots and yellow reticulations. Careful examination of many *Abalistes* specimens led us to conclude that the former is a new species and the latter is *A. stellatus*. We herein describe the new species as *A. filamentosus*.

Materials and methods

The methods of counting and measuring primarily follow those of Matsuura (1980). The body width was measured between the pectoral-fin bases; the length of the middle caudal-fin ray was the distance between the caudal-fin base to the tip of middle caudal-fin ray; and, the postorbital length was measured from the upper end of the gill opening to the nearest point of the orbital edge. The pectoral-fin ray count excludes the uppermost rudimentary ray. Standard length and head length are abbreviated as SL and HL, respectively. In the following description, data in parentheses refer to

* author for correspondence

Table 1. Frequency distributions of fin-ray counts and scale-rows in two species of *Abalistes*.

species	dorsal-fin rays			anal-fin rays					pectoral-fin rays	
	25	26	27	22	23	24	25	26	14	15
A. filamentosus n.sp.	4	10	3	1	3	9	4	0	16	1
A. stellatus	0	12	11	0	0	14	8	1	22	1

	body scale-rows												
	33	34	35	36	37	38	39	40	41	42	43	44	45
A. filamentosus n.sp.	1	3	5	3	1	3	1	0	0	0	0	0	0
A. stellatus	0	0	4	4	1	3	2	4	2	0	0	0	1

	head scale-rows								
	25	26	27	28	29	30	31	32	33
A. filamentosus n.sp.	1	0	6	3	2	3	1	1	0
A. stellatus	0	2	5	4	5	3	2	1	1

the paratypes when they differ from the holotype. Institutional abbreviations follow Leviton *et al.* (1985).

Comparative material examined. *Abalistes stellatus*, 46 specimens, 57–395 mm SL. Japan, Ryukyu Islands: HUMZ 46138, NSMT-P 65598, URM-P 3304, 3326; South China Sea: HUMZ 37979, 38206, 38252, 38353, 38292, 38304, 38306, 38307, 50109, 50123; Indonesia, Ambon: BPBM 19459; Australia: BMNH unregistered 57 mm (holotype of *Balistes phalreatus*), AMS I.16218-001, AMS I.15557-266; Indian Ocean: BMNH 1865.3.18.2, HUMZ 6517–6526, (10), 6803, 6805, 89452, 89453, NSMT-P 45065 (4), RUSI 2870 (5), RUSI 38483, RUSI 48248, SAM 33694, ZRC 38091.

Abalistes filamentosus n.sp.

Fig. 1a

Abalistes stellatus.—Matsuura, 1980, p. 39 (in part); Matsuura, 1984 (in part), pl. 322–I.
Abalistes stellaris.—Matsuura, 1985, pp. 626, 627, 743.

Type material. HOLOTYPE: NSMT-P 65579, 243 mm SL, female, Ryukyu Islands, south coast of Okinawa-jima Island, off Itoman, 17 June 1982, hook and line, T. Yoshino (obtained from local fisherman). PARATYPES: AMS I.37974-001, 283 mm SL, Timor Sea, 09°57.15'S 129°31.96'E, 65 m depth, trawl, 30–31 March 1995, J. Lloyd (NT Fisheries); CSIRO H.1075-02, 216 mm SL, Western Australia, north of Monte Bello Islands, 19°56.2'–19°57.6'S 115°35.5'–115°36.8'E, 66–68 m depth, 8 October 1987, demersal trawl, FRV Soela; CSIRO H.2455-04, 245 mm SL, Western Australia, north of Dampier Archipelago, 19°10.1'–19°11.8'S 116°47.1'–116°46.5'E, 180–166 m depth, 3 October 1989, demersal trawl, W. Whitelaw (CSIRO); CSIRO H.3223-03, 227 mm SL, Western Australia, north of Barrow Island, 20°10.2'–20°08.7'S 115°15.6'–115°15.1'E, 10 October 1990, demersal trawl, FRV Southern Surveyor; HUMZ 38667, 277 mm SL, Ryukyu Islands, south coast of Okinawa-jima Island, off Itoman, 9 March 1974, hook and line, K. Matsuura (obtained from local fisherman); HUMZ 38705, 228 mm SL, Ryukyu Islands, south coast of Okinawa-jima Island, off Ohjima, 15 April 1974, hook and line, T. Shimizu (obtained from local fisherman); HUMZ 38706, 282 mm SL, Ryukyu Islands, west coast of Okinawa-jima Island, off Naha, 5 April 1974, hook and line, T. Shimizu (obtained from local fisherman); HUMZ 68923, 325 mm SL, Ryukyu Islands, south coast of Okinawa-jima Island, off Itoman, 9 March 1974, K. Matsuura (obtained from local fisherman); HUMZ 68924, 281 mm SL, data same as preceding paratype; HUMZ 68925, 267 mm SL, data same as preceding paratype; HUMZ 68926, 296 mm SL, data same as preceding paratype; NSMT-P 49363, 233 mm SL, Ryukyu Islands, Yaeyama Group, Nakano-ogan-jima Island, 24°07.2'N 123°40.1'E, 152 m depth, 14 August 1996, hook and line, K. Yano; NSMT-P 65580, 317 mm SL, Ryukyu Islands, south coast of Okinawa-jima Island, off Itoman, 18 June 1982, long line, T. Yoshino (obtained from local fisherman); URM-P 3320, 295 mm SL, male, data same as holotype; URM-P 3321, 253 mm SL, !, data same as holotype; URM-P 3334, 274 mm SL, Ryukyu Islands, south coast of Okinawa-jima Island, off Itoman, 18 June 1982, long line, T. Yoshino (obtained from local fisherman).

Diagnosis. Dorsal rays III+25–27; anal rays 22–25; pectoral rays 14–15 (usually 14); body scale rows 33–39; head scale rows 25–32 (Table 1). Upper and lower rays of caudal fin greatly produced in filaments. Cheek with 3 or 4 longitudinal grooves. Proximal part of spinous dorsal fin dark brown; no yellow/pale blue spots or yellow reticulations on the body; ground colour of body dark brown dorsally, mottled with irregular pale markings, becoming white ventrally; cheek brown with greenish tinge.

Description. Body depth 2.7 (2.6–3.2) in SL, head length 2.9 (2.8–3.0) in SL, snout length 4.1 (3.9–4.3) in SL, snout to origin of first dorsal spine 2.6 (2.5–2.7) in SL, snout to origin of anal fin 1.5 (1.5–1.6) in SL, base of soft dorsal fin 3.3 (3.0–3.3) in SL, base of anal fin 3.5 (3.4–3.8) in SL. Body width 1.7 (1.7–2.2) in HL, eye diameter 4.3 (3.5–5.3) in HL, interorbital width 3.3 (2.9–3.5) in HL, length of gill opening 3.4 (3.2–4.2) in HL, postorbital length 5.3 (4.5–5.1) in HL, depth of caudal peduncle 8.5 (7.4–10.8) in HL, length of caudal peduncle 2.4 (2.0–2.7) in HL, length of first dorsal-fin spine 1.7 (1.5–2.0) in HL, length of longest soft dorsal-fin ray 2.9 (2.5–3.4) in HL, length of longest anal-fin ray 2.8 (2.8–4.3) in HL, length of middle caudal-fin ray 2.3 (2.2–2.6) in HL, length of pectoral fin 3.0 (2.8–3.5) in HL.

Body relatively elongate, compressed, covered with rhomboidal, plate-like scales as in other balistids; several longitudinal rows of small tubercles on posterior part of body extending forward from caudal-fin base to below posterior part of soft dorsal fin. Dorsal and ventral profiles of head convex. Scales on cheek forming several longitudinal rows, having 3–4 longitudinal grooves between scale rows. Mouth small, terminal, with thin fleshy lips; teeth incisiform, notched on edges; each upper jaw with 4 teeth in outer series and 3 teeth in inner series; each lower jaw with 4 teeth in a single series. Gill opening small, slit-like, slightly oblique, located behind and below eye; a patch of enlarged osseous scales just behind upper end of gill opening. Origin of spinous dorsal fin above pectoral-fin base; first dorsal spine very long and stout, covered

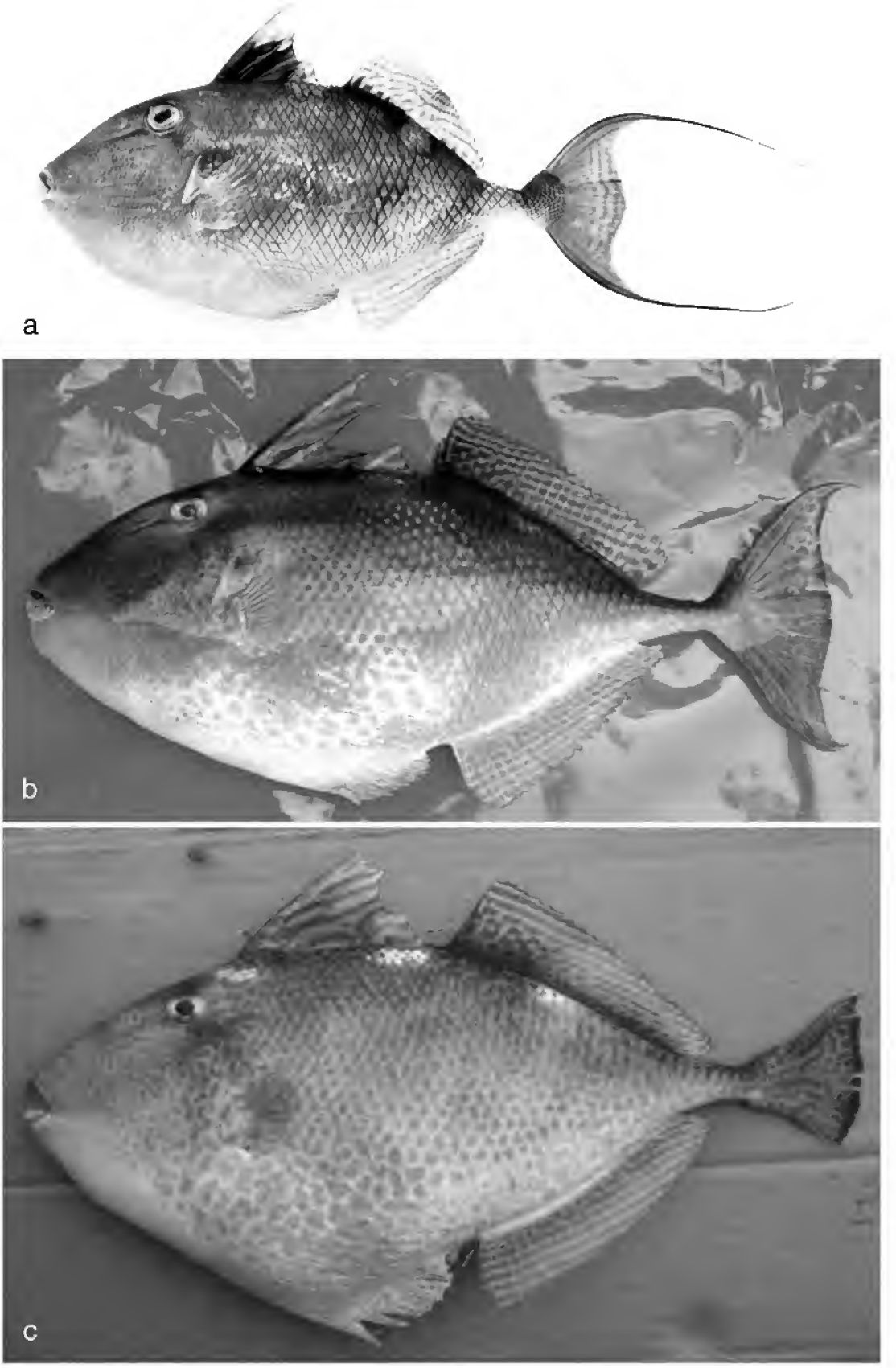

Fig. 1. *Abalistes filamentosus* n.sp. and *A. stellatus*. (*a*) *Abalistes filamentosus* n.sp., NSMT-P 65579, holotype, 243 mm SL, Ryukyu Islands, Japan; (*b*) *A. stellatus* NSMT-P 65598, 354 mm SL, Ryukyu Islands, Japan; (*c*) *A. stellatus* URM-P 3304, 395 mm, Ryukyu Islands, Japan.

Table 2. Measurements of type specimens of *Abalistes filamentosus* expressed as percentages of standard length with comparisons to *A. stellatus*.

	Abalistes filamentosus								
	holotype	paratypes (continued on facing page)							
collection	NSMT-P	AMS I.	CSIRO	CSIRO	CSIRO	NSMT-P	NSMT-P	HUMZ	HUMZ
registration number	65579	37974-001	H1075-02	H2455-04	H3223-03	49363	65580	38667	38705
standard length (mm)	243	283	216	245	227	231	317	277	228
body depth	37.4	34.6	37.0	35.5	37.4	38.5	30.9	34.3	36.8
body width	21.0	17.7	17.6	18.0	18.5	18.2	16.4	16.2	18.9
head length	35.0	35.0	33.3	33.1	33.5	35.1	34.1	34.3	35.5
snout length	24.7	25.8	24.5	25.3	24.2	25.1	25.2	23.5	25.4
snout to origin of first-dorsal spine	38.3	38.9	39.4	40.4	38.8	39.0	37.5	36.8	39.0
snout to origin of anal fin	66.7	63.6	63.0	64.1	65.6	63.6	63.4	65.7	64.5
interdorsal space	21.4	19.1	23.6	21.2	23.3	21.6	22.4	22.7	23.2
postorbital length	6.6	7.8	6.9	6.9	6.6	7.4	6.9	7.2	7.5
eye diameter	8.2	7.4	7.4	9.4	8.8	8.2	6.9	7.9	7.5
interorbital width	10.7	10.6	11.1	10.2	11.0	11.7	9.8	11.2	11.4
length of gill opening	10.3	8.8	8.8	9.4	7.9	10.0	9.8	10.5	9.6
length of first-dorsal spine	21.0	19.4	—	20.4	—	22.9	16.7	19.5	21.1
length of longest doral-fin ray	11.9	11.0	11.6	10.6	10.6	10.4	11.0	11.2	14.0
length of longests anal-fin ray	12.3	8.5	10.2	9.8	8.8	8.2	10.4	10.1	12.3
length of pectoral fin	11.5	10.2	10.6	11.4	11.0	10.8	11.4	10.1	11.8
length of mid-caudal-fin ray	15.2	14.5	14.4	14.7	13.7	16.0	13.9	13.4	15.4
depth of caudal peduncle	4.1	3.9	4.2	4.1	4.0	4.3	3.2	4.0	3.9
length of caudal peduncle	14.4	13.1	16.2	14.3	14.1	14.3	13.9	15.2	14.5
length of soft dorsal-fin base	30.5	31.8	30.6	32.7	30.8	32.0	31.5	31.4	31.6
length of anal-fin base	28.4	29.0	27.8	28.2	28.6	28.6	28.4	27.4	28.5

anteriorly with tubercles; second dorsal spine about three-fourths of first spine; third dorsal spine shorter and more slender than second spine, but prominently projecting above dorsal contour. Soft dorsal and anal fins similar to each other in shape, gently rounded. Pelvic dewlap not developed; encasing scales movable dorsoventrally, attached to posterior end of pelvis. Caudal fin double emarginated, upper and lower rays greatly produced posteriorly into filaments, usually much longer than head length. Caudal peduncle depressed, wider than deep.

Live coloration. Dorsal half of body dark brown mottled with irregular pale markings; 3 white blotches on back, first below base of first dorsal-fin spine, second immediately behind third dorsal-fin spine, and third below middle of soft dorsal fin; cheek greenish brown with 3–4 longitudinal dark brown grooves; ventral half of body pale or white; dorsal half of snout brown; first dorsal fin with large dark brown area on proximal part, pale distally with brown lines; soft dorsal and anal fins pale with 4–5 horizontal wavy brown lines; base of soft dorsal fin dark brown but base of anal fin white; base of caudal fin dark brown dorsally, white ventrally; caudal fin brown or yellowish brown proximally, paler distally with 3–4 vertical wavy brown lines; upper and lower filamentous rays dark brown.

Sexual dimorphism. The holotype and two paratypes (URM-P 3320 and 3321) were dissected to examine gonads; the holotype and URM-P 3321 are females and URM-P 3320 is male. These specimens do not show sexual dimorphism in shape and colour.

Etymology. The new species is named *filamentosus* after the filamentous rays in its caudal fin.

Distribution. *Abalistes filamentosus* is known from the Ryukyu Islands in Japan, the North West Shelf of Australia, and the Timor Sea. The capture records of the type specimens range from 61 to 180 m.

Remarks. The type specimens of *A. filamentosus* were compared with 46 specimens of *A. stellatus*. As shown in the Diagnosis, *A. filamentosus* differs from *A. stellatus* (Fig. 1b,c) in having filamentous caudal-fin rays, 3–4 longitudinal grooves on the cheek, and the body without colourful markings. The soft rays of the dorsal and anal fins of *A. filamentosus* have relatively lower counts with wider ranges than those of *A. stellatus* (Table 1). No clear differences are found between two species in proportional measurements (Table 2).

Richardson (1845) described *Balistes vachellii* on the basis of a specimen (3.75 inches = 9.5 cm in length) collected from Canton, China, by Rev. George Vachell. Although the type specimen was apparently lost, Richardson stated "No naked spaces exist on the cheek" and "The end of the caudal is even, but the second ray above and below forms a little projecting point". These characters show that *Balistes vachellii* is a junior synonym of *Abalistes stellatus* (Anonymous, 1798). Richardson (1846) described *Balistes phalreatus* from a single specimen (2.25 inches = 5.7 cm SL) collected from the western coasts of Australia (no detailed locality given). His description and the plate (plate 1, figs. 4–5) show that *Balistes phalreatus* is *Abalistes stellatus*. Examination of the type specimen confirms that it does not have any grooves on the cheek.

There are complicated nomenclatural problems with the name *Abalistes stellatus*. Two similar specific names, *stellaris* and *stellatus*, have been used for this triggerfish by many authors. The specific name, *stellaris*, was first given to the species by Bloch & Schneider (1801) based on Lacepède's

Table 2. (Continued from facing page). Measurements of type specimens of *Abalistes filamentosus* expressed as percentages of standard length with comparisons to *A. stellatus*.

Abalistes filamentosus paratypes (continued from facing page)										*Abalistes stellatus*	
HUMZ 38706	HUMZ 68923	HUMZ 68924	HUMZ 68925	HUMZ 68926	URM-P 3320	URM-P 3321	URM-P 3334	range	(mean)	range	(mean)
282	325	281	267	296	295	253	274	216–325	(267)	110–395	(244)
34.4	31.4	32.0	32.6	35.5	34.2	35.2	35.4	30.9–38.5	(34.9)	27.8–37.9	(34.3)
15.2	18.2	16.4	17.2	16.6	18.6	19.8	20.4	15.2–21.0	(17.9)	12.8–19.9	(17.2)
33.3	33.8	33.8	34.5	34.1	34.2	34.0	34.3	33.1–35.5	(34.2)	27.8–37.1	(32.9)
24.5	24.3	24.9	25.5	25.0	25.1	24.5	24.5	23.5–25.8	(24.8)	19.7–25.2	(22.9)
36.9	36.9	36.7	38.2	38.2	36.9	37.9	38.0	36.7–40.4	(38.1)	29.4–36.2	(40.9)
61.7	63.1	63.0	62.9	62.5	61.0	65.2	63.9	61.0–66.7	(63.7)	50.0–68.0	(61.3)
22.3	23.1	22.4	22.5	23.0	21.0	22.9	21.2	19.1–23.6	(22.2)	19.8–25.6	(22.9)
7.1	7.1	6.8	7.5	7.1	7.5	7.1	7.3	6.6–7.8	(7.1)	6.1–8.5	(7.2)
6.7	7.4	6.8	7.1	7.8	6.4	8.3	7.3	6.4–9.4	(7.6)	5.1–11.4	(7.8)
9.9	9.8	11.0	10.1	10.8	10.2	11.9	10.9	9.8–11.9	(10.7)	8.0–13.3	(10.7)
9.2	10.2	10.0	10.1	10.5	8.8	10.7	9.9	7.9–10.7	(9.7)	6.1–11.2	(9.2)
19.1	19.1	19.9	21.3	19.9	21.0	18.2	19.7	16.7–22.9	(17.6)	13.9–25.6	(20.5)
10.3	10.8	10.3	10.9	10.8	12.2	12.6	13.1	13.0–14.0	(11.4)	8.5–14.4	(12.0)
8.9	9.5	8.9	9.7	9.5	11.2	11.5	10.9	8.2–12.3	(10.0)	7.0–13.7	(11.1)
10.6	11.4	9.6	10.5	10.5	11.9	11.9	12.0	9.6–12.0	(11.0)	7.8–12.3	(10.4)
13.5	12.9	13.5	14.2	14.5	14.6	15.4	14.6	12.9–16.0	(14.4)	11.9–18.2	(14.5)
3.9	4.0	3.9	3.7	4.1	4.1	4.0	4.0	3.2–4.3	(4.0)	3.2–5.1	(4.0)
16.3	16.6	15.7	14.2	14.2	15.3	16.2	15.7	13.1–16.6	(14.9)	11.2–17.1	(14.7)
30.9	31.7	31.0	31.8	30.7	32.9	30.0	32.1	30.3–32.9	(31.4)	24.5–33.2	(30.6)
28.4	28.9	28.8	28.5	28.0	29.2	26.1	27.4	26.1–29.2	(28.2)	23.6–31.6	(28.6)

(1798) publication. The name *stellaris* has been applied to this triggerfish by authors such as Herre (1924), Fowler (1928), McCulloch (1929), Smith (1949), Munro (1955), Kyushin *et al.* (1977), Dor (1984), Matsuura (1984, 1985, 2001), Winterbottom *et al.* (1989), and Hayashi (2002). The name *stellatus* has also been applied to this species by authors such as Rüppell (1828), Bleeker (1865–1869), Günther (1870, 1910), Day (1875), Macleay (1881), Barnard (1927), Whitley (1941), de Beaufort & Briggs (1962), Matsuura (1980), Smith & Heemstra (1986), Allen & Swainston (1988), Randall *et al.* (1990), Kuiter (1993, 1997), Randall (1995), Myers (1999), and Iwatsuki *et al.* (2000). Whitley (1941), de Beaufort & Briggs (1962) and Matsuura (1980) showed that Anonymous (1798) first used the Latinized specific name, *stellatus*, for this species, although the description by Anonymous was based on Lacepède's (1798) publication. Other authors attribute the authorship to Lacepède (1798). Allen & Swainston (1988) provided an excellent illustration and short account of this species but added to the confusion by applying the authorship of Bloch & Schneider to *stellatus*. Matsuura (2001) stated that *Abalistes stellatus* (Lacepède, 1798) is invalid because Lacepède did not describe the species using a scientific name but only the French vernacular name.

As shown by Matsuura (2001), this taxon was described by Lacepède (1798: 333, 350, pl. 1, fig. 1) under the French vernacular name, Baliste étoilé. Lacepède's publication was briefly reviewed in the same year by Anonymous in an article in the Allgemeine Literatur-Zeitung (general literature newspaper). Anonymous gave brief descriptions of triggerfishes and filefishes on pages 681 and 682.

Hannelore Paxton kindly provided comments about problems in the article: Anonymous sometimes confused pectoral and pelvic fins, and in most places he did not distinguish between the first (spinous) and second dorsal fins, but he sometimes did. Her translation is given below with our interpretation in square brackets.

> ...(6) *Balistes*. This genus has been brought under four subdivisions. a) *Balistes* with more than one ray in the pectoral [lapsus for pelvic] and dorsal fins.—*Vetula*; this species has remarkably beautiful colours. ...—*Stellatus* (*etoile*) [with no accent] from Commerson's papers/manuscripts, is a new species, which he has caught around the Isle de France [Mauritius]. Small spots are distributed over the whole body, 8 or 10 rays [lapsus for spiny elements along the edge of the ventral flap] are in the pelvic fin, without spines on the side of the tail.—*Echarpe* [with no accent], taken from the same paper/manuscript, characterized particularly by its broad black stripe, running obliquely from the eye to the anal fin, giving it the species name, with 8 to 10 stripes [lapsus for spiny elements along the edge of the pelvic dewlap] in the pelvic fin, 4 rows of spines on the side of the tail; from the seas around the Isle de France. This subdivision includes biaculeatus [neither capitalized nor italicised] L. b) *Balistes* with more than one ray in the pectoral fin [lapsus for pelvic] and in the dorsal fin [lapsus, not including "first"]. Here we find only the species sinensis [neither capitalized nor italicised] L. c) *Balistes* with 1 single ray in the pectoral fin [lapsus for pelvic] and more than 1 in the dorsal fin [lapsus not including "first"]. —*tomentosus*, —*papillosus*, etc. d) *Balistes* with a single ray in the first pectoral and dorsal fins [lapsus, as first presumably should only go with dorsal]. Here are the species *monoceros* and *hispidus* of Linne.

It is clear that Anonymous intended to state that *Balistes* has four subdivisions including *Vetula, Stellatus* (*etoile*) and *Echarpe*, and this shows that the idea of binominal nomenclature was used by Anonymous. Thus, we conclude that *Balistes stellatus* was proposed and available by Anonymous.

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A New Cucumberfish (Paraulopidae) of the *Paraulopus nigripinnis* Complex from Central Eastern Australia

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ABSTRACT. A new species of cucumberfish, *Paraulopus melanogrammus*, is described from upper slope depths of southern Queensland and northern New South Wales in the western Tasman Sea. It is distinguishable from other members of the *P. nigripinnis* complex, with which it shares 4.5–5.5 scales above the lateral line, the presence of supraocular ridges and a large maximum size, by a combination of characters, including a distinctive black leading edge along the full anterior margin of the dorsal fin of adults. In juveniles, the black margin is broken by a pale space midway along the fin.

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A study by Sato & Nakabo (2001) of species long placed in the genus *Chlorophthalmus* Bonaparte, 1840 identified two evolutionarily separate assemblages, a world-wide group comprising 17 species, which includes the type species of the genus *C. agassizi* Bonaparte, 1840, and an Indo-Pacific group with eight named species, for which they erected the genus *Paraulopus* and family *Paraulopidae*. Only two of the eight species of *Paraulopus* had been described or reliably recorded from the Australasian region, the Australian and New Zealand *P. nigripinnis* (Günther, 1878) and the New Caledonian *P. legandi* (Fourmanoir & Rivaton, 1979). Sato & Nakabo (2002) subsequently described two new species, *P. okamurai* and *P. novaeseelandiae* from New Zealand and eastern Australia and related them to *P. nigripinnis* in sharing 4.5–5.5 scales above the lateral line, supraocular ridges and a large maximum size, rather than the 2.5–3.5 scales above the lateral line, absence of supraocular ridges and rather small maximum body size in the remaining seven species. The authors also proposed the use of the vernacular 'cucumberfish' for representatives of the family. The recognition of another two species *P.* n.sp. 1 and *P.* n.sp. 2 (Sato *et al.*, submitted for publication) from southern and western Australia, respectively, brought to five the number of Australasian *Paraulopus* spp.

The purpose of this paper is to describe yet another Australian species belonging to this group, which occurs in upper slope waters of central and southern Queensland and northern New South Wales.

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Materials and methods

Terminology and methodology is that of Hubbs & Lagler (1949), except as follows. Body depth and width were measured at the origin of the dorsal fin. Head width and depth were measured at the posterior extent of the orbit. Interorbital width is the minimum width of the frontal bones forming the dorsal margin of the orbits. The upper-jaw length was measured to the dorsoposterior corner of the maxilla. Dorsal- and anal-fin heights are the lengths of the longest rays. The adipose-fin length is the distance from its origin to its dorsoposterior tip. The lengths of the pectoral and pelvic fins were measured from the dorsal and lateral origins, respectively, to the posteriormost tip. Numbers of vertebrae were taken from radiographs. The description of the new species is based on the holotype, with variations observed in paratypes enclosed in parentheses. Institutional abbreviations used are those of Leviton *et al.* (1985). Parenthetical expressions following registration numbers in the material examined sections indicate the number of specimens, size range in mm standard length (SL) and sex, where determined, present in each lot.

Paraulopus melanogrammus n.sp.

Figs. 1, 2; Table 1

Type material. HOLOTYPE: CSIRO H.3644-10 (165, ♀) east of Rockingham Bay, Queensland, 17°56.4'S 147°02.7'E to 17°59.7'S 147°07.5'E, 303–320 m, bottom trawl, 30 November 1993, SS07/93/T3, FRV Southern Surveyor. PARATYPES: AMS I.25802-011 (7, 85.7–143, juveniles) just northeast of Townsville, Queensland, 18°00'S 147°01'E to 17°48'S 146°58'E, 224–228 m, bottom trawl, 9 January 1986, So1/86/05, RV Soela, M. McGrouther & S. Reader; AMS I.25803-011 (5, 82.4–95.2) just northeast of Townsville, Queensland, 17°57'S 146°58'E, 220 m, bottom trawl, 9 January 1986, So1/86/06, RV Soela, M. McGrouther & S. Reader; AMS I.25804-006 (3, 168–191, ♂) northeast of Townsville, Queensland, 17°59'S 147°03'E to 17°57'S 147°01'E, 260 m, bottom trawl, 9 January 1986, So1/86/07, RV Soela, M. McGrouther & S. Reader; CSIRO H.682-05 (2, 132–163, ♀) NE of Townsville, Queensland Plateau, Queensland, 17°59.9'S 147°02.9'E to 17°57.6'S 147°00.3'E, 250–252 m, bottom trawl, 29 November 1985, So6/85/44, RV Soela; CSIRO H.698-12 (5, 153–221, ♂♀) east of Bowen, Marian Plateau, Queensland, 19°29.2'S 150°16.5'E to 19°29.8'S 150°17.8'E, 324–328 m, bottom trawl, 15 November 1985, So6/85/01, RV Soela; CSIRO H.3644-27 (161, ♀) east of Rockingham Bay, Queensland, 17°56.4'S 147°02.7'E to 17°59.7'S 147°07.5'E, 303–320 m, bottom trawl, 30 November 1993, SS07/93/T3, FRV Southern Surveyor; CSIRO H.3644-28 (187, ♂) same locality as H3644-27; CSIRO H.947-22 (243, ♀) Saumarez Plateau, south of Saumarez Reef, Queensland, 22°53.7'S 154°20.1'E to 22°56.5'S 154°21.5'E, 590–606 m, bottom trawl, 17 November 1985, So6/85/8, RV Soela; NMV A4548 (3, 132–164) 90 km east of Dunk Island, Queensland, 17°59.1'S 147°03.4'E to 17°57'S 147°01'E, 260 m, bottom trawl, 9 January 1986, So1/86/7, RV Soela, M. Gomon; NMV A4550 (4, 121–159) 90 km east of Dunk Island, Queensland, 18°00.1'S 147°03.4'E to 17°56.9'S 147°00.1'E, 264 m, bottom trawl, 10 January 1986, So1/86/8, RV Soela, M. Gomon; QM I.21012 (8, 161–211) east of Tweed Heads, Queensland, 28°12'S 153°54'E, 235 m, Queensland Fisheries Service, 27 July 1982; QM I.25578 (4, 131–165) off Proserpine, Queensland, 20°32'S 152°48'E, 408 m, Raptis Fishing Company, April 1997; QM I.25697 (5, 92.0–100) off Swain Reefs, Queensland, 21°42'S 152°55'E, 185–190 m, Raptis Fishing Company, April 1997; QM I.27212 (2, 194–223, ♂) east of Lady Elliot Island, Queensland, c. 24°00'S 154°00'E, 400 m, D.Tuma, 1 July 1991.

Non-type material. AMS I.15520-007 (2, 85–114) 16°17'S 153°52'E, 229 m, 26 July 1968; AMS I.15526-005 (2, 142–169, ♀) 26°32'S 153°50'E, 274 m, 27 July 1968; AMS I.15527-005 (120) 26°32'S 153°51'E, 320 m, 27 July 1968; AMS I.15542-002 (122) 26°30'S 153°44'E, 184 m, 29 July 1968; AMS I.15550-001 (2, 120–136, juveniles) 26°31'S 153°50'E, 263–329 m, 5 August 1968; AMS I.15976-027 (68, juvenile) 32°50'S 152°43'E, 585 m, 7 May 1971; AMS I.20319-006 (120) 30°23'S 153°25'E, 270 m, 19 August 1977; AMS I.29734-008 (185) 28°05'S 153°52'E, 229 m, 16 August 1978; AMS I.33285-010 (168) 30°18'S 153°27'E, 365 m, 15 June 1992; AMS I.38808-008 (6, 78.5–86.7, juveniles) 21°50.99'S 153°01.39'E to 21°59.43'S 153°06.60'E, 199 m, 10–11 September 1995; CSIRO CA1186 (1, 184, ♀) 25°55'S 153°53'E to 26°03'S 153°53'E, 179–300 m, 26 November 1980; CSIRO CA1187 (1, 188, ♀) same locality as CA1186; CSIRO H.594-07 (1, 132, juvenile) 18°05.9'S 147°10.8'E to 18°10.0'S 147°13.2'E, 248–240 m, 8 December 1985; CSIRO H.594-13 (2, 117–137, ♂♀) same locality as H594-07; CSIRO H.3644-29 (4, 136–193, ♂♀) same locality as H3644-27; NMV A4137 (1, 90.6, juvenile) 18°00.1'S 147°02.1'E to 17°57'S 146°59'E, 220 m, 9 January 1986; NMV A4549 (1, 134, juvenile) 17°59.1'S 147°00.3'E to 17°56.1'S 146°57.9'E, 218–220 m, 9 January 1986; QM I.27007 (9, 147–191, ♂♀) 23°54'S 152°49'E, 150 m, 23 November 1990.

Diagnosis. Pectoral-fin rays 15–17 (usually 16); vertebrae 47–49 (usually 48); gill-rakers 4–5+15–17 (usually 16), upper limb with three fully formed rakers and one or two rudiments; lateral-line scales 47–49 (usually 48); 4.5 scales above lateral line; three rows of scales on cheeks; supraocular ridge above middle three-quarters of eye; eye large 2.5–3.1 (mean 2.7) in head; adipose fin moderately small, 1.7–3.7% (mean 3.1%) SL; anal fin of moderate height, 20.1–24.9% (mean 22.7%) SL; pelvic fin distinctly longer than pectoral fin; dorsal fin with distinctly black leading edge basally and distally (juveniles) or along entire margin (adults).

Description. Dorsal-fin rays 11; anal-fin rays 10 (9–10); caudal-fin rays 18; pectoral-fin rays 16 (15–17, rarely 15); pelvic-fin rays 9; vertebrae 48 (47 in 4 and 49 in 10 of 42); lateral-line scales 49 (47–49, rarely 47); scales above lateral line 4.5; scales below lateral line 4; predorsal scales 13 (12–13); gill-rakers 5+15 (4–5+15–17). (See Table 1 for morphometric values).

Body cigar-shaped, evenly tapering to slender caudal peduncle; anus slightly closer to pelvic-fin base than to anal-fin origin (encircled with dark tissue in some large specimens). Head pointed, rather cylindrical, only very slightly depressed at most; dorsal outline of nape and head fairly straight in lateral profile; snout short. Nostrils ovoid, positioned midway between eye and tip of snout, subdivided by transverse flap of skin. Superocular ridge on either side

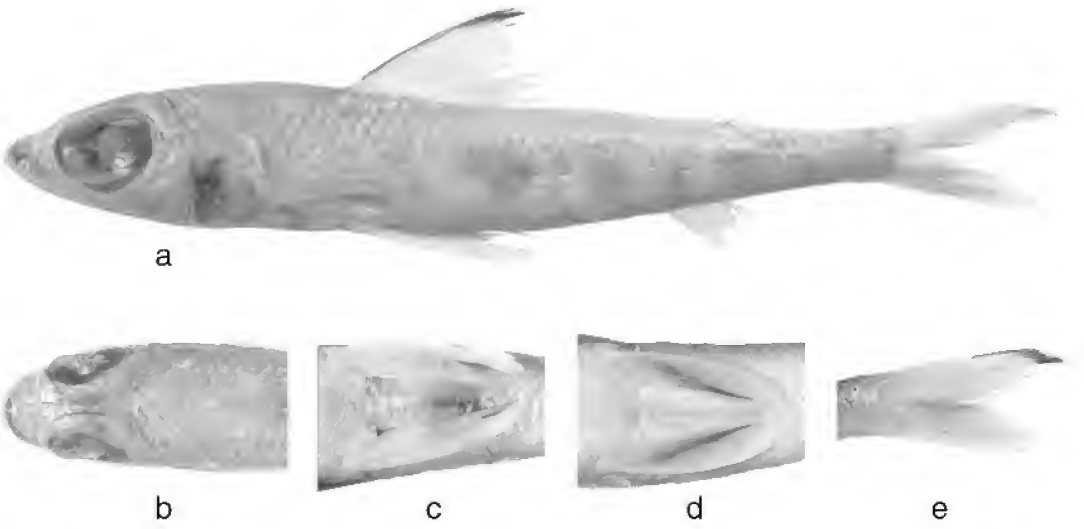

Fig. 1. *Paraulopus melanogrammus* n.sp. (*a*) lateral view of preserved holotype, CSIRO H.3644-10, 165 mm SL, female; (*b*) dorsal view of head of preserved holotype; (*c*) ventral view of pelvic fins of preserved holotype; (*d*) ventral view of pelvic fins of preserved paratype, CSIRO H.698-12, 217 mm SL, male; and (*e*) lateral view of caudal fin, same paratype.

above central three-quarters of eye. Eye large, positioned dorsolaterally, on dorsal profile of head. Posterior edge of preopercle smooth, broadly curved. Mouth terminal; dorsoposterior corner of maxilla below centre of eye. Teeth on jaws fine, in broad strip anteriorly extending onto lateral surfaces of premaxilla and dentary, tapering to narrow strip posteriorly. Vomerine teeth fine in narrow transverse band, continuous with posteriorly tapering band of teeth on exposed edge of palatine; hyoid teeth fine, in ovoid patch on each side, axis angled anteromesially at anterolateral corner of tongue, teeth on lateral periphery slightly enlarged. Gill rakers on upper arm of first arch short, those on lower limb moderately long and slender, with one or two rudimentary rakers at both dorsal and ventral ends of arch.

Scales large, cycloid. Predorsal scales extending forward to vertical through posterior extent of eye. Cheek scales large, covering cheek and preopercle, in about 3 poorly defined rows. Lateral line positioned midlaterally on side, anterior end slightly raised.

Dorsal fin moderately tall, with short base, second ray longest but only marginally longer than first, subsequent rays decreasing in length; first two rays unbranched, subsequent rays branched; origin of fin at vertical through midpoint between origins of pectoral and pelvic fins; adipose fin small but obvious, positioned just in advance of vertical through posterior end of anal-fin base. Anal fin short based, of moderate height, first ray shortest, length of subsequent rays subequal, first two unbranched, others branched; anal-fin origin slightly closer to base of tail than to pelvic-fin origin. Caudal fin distinctly forked, upper lobe slightly longer than lower. Posterior tip of pectoral fin reaching beyond origin of pelvic but not to vertical through centre of that fin; sixth ray longest; first ray simple, others branched. Tip of last pelvic-fin ray reaching just past anus, not quite half way between pelvic-fin origin and anal-fin origin; posterior margin distinctly concave; first ray unbranched, others branched.

Largest specimen examined 243 mm SL.

Preserved coloration (in alcohol). Body of holotype (female; Fig. 1a) pale, slightly duskier dorsally with about five obscure dusky blotches mostly centered on lateral midline; largest blotch immediately posterior to vertical through posterior end of dorsal-fin base; next largest a horizontally elongate blotch posterior to vertical through adipose fin; narrow strip of dark blue subdermal tissue on ventral midline extending from interpelvic space to anus. Head with transverse, dusky band at tip of snout bordering premaxilla and maxilla; dark botch on ventral two-thirds of opercle immediately posterior to preopercular margin (obscured by opalescence in many specimens). Dorsal fin rather pale with narrow, dark leading edge covering all but base of first dorsal fin ray, dark area expanding distally to tip of third ray; triangular, posteriorly tapering faint dusky area covering midlateral portion of fin; fin paler basally and distally, especially adjacent to dark leading edge dorsally (in large specimens dorsal fin pale dusky with pale dorsal margin and dark marginal line confluent with dark leading edge). Adipose fin slightly dusky. Anal fin pale. Caudal fin pale with duskier lower lobe and increasingly dusky upper lobe distally; upper lobe with narrow dark dorsal margin distally (in large specimens caudal fin slightly dusky, middle part of fin especially on lower lobe darkest, with pale posterior margin and dark margin both dorsally and posteriorly on upper lobe as in Fig. 1e, and sometimes centrally on ventral edge of lower lobe). Pectoral fin pale with narrow dusky leading edge (not apparent in Fig. 1). Pelvic fin mostly pale with detectable transverse dusky band on underside three-quarters of way to tip (Fig. 1c; some with dusky distal lobe).

Males pigmented like females, except leading edge of dorsal fin pale at tip in some, distal edge of dorsal fin with narrow dark margin and pelvic fin pale with broad, tapering dusky to dark band on underside running from near bases of outer rays to tips of inner rays (Fig. 1d). Some large males having anal fin with small dark spot on base of first ray, second on distal tip of second ray and third on ventral edge of lower lobe.

Juveniles with more numerous and better defined blotches on side, most apparent below lateral midline. Leading edge of dorsal fin dark basally and distally, first ray entirely dark, second ray only dark near tip. Caudal fin dusky only on lower lobe and distally on upper. Pelvic fin entirely pale.

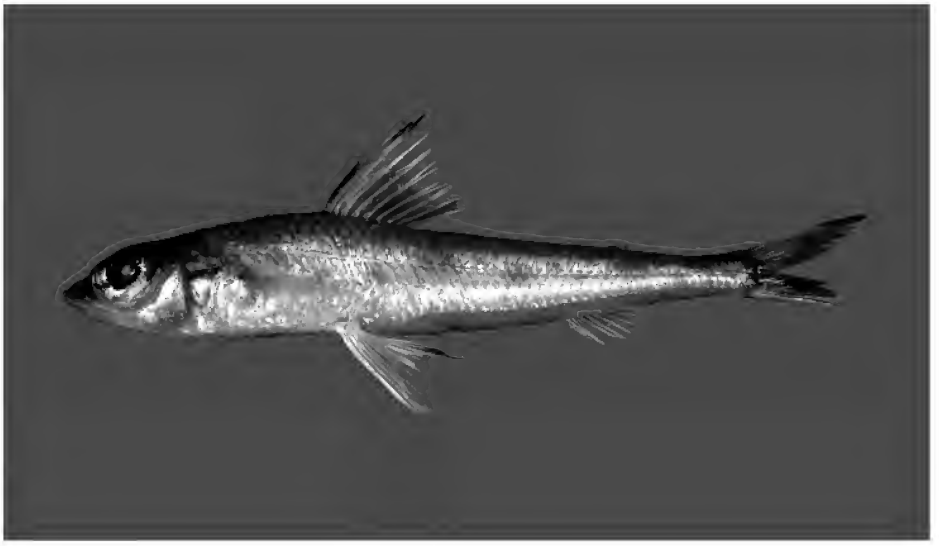

Fig. 2. *Paraulopus melanogrammus* n.sp., holotype (fresh), CSIRO H.3644-10, 165 mm SL, female, east of Rockingham Bay, Queensland, 17°56.4'S 147°02.7'E to 17°59.7'S 147°07.5'E, 303–320 m.

Table 1. Selected morphometric values expressed as a percent of standard length (SL) and head length (HL) for the holotype and paratypes of *Paraulopus melanogrammus* n.sp.

number of specimens: SL	holotype 165		paratypes 57: 85.7–243	
	%SL	%HL	%SL	%HL
body depth	15.8		12.8–17.7	
body width	15.7		12.7–16.0	
head length	30.2		28.6–30.4	
head depth	15.0	49.5	10.6–15.4	37.0–51.3
head width	16.4	54.1	14.1–15.8	48.2–53.6
snout length	7.4	24.6	6.6–8.0	23.1–27.0
orbital diameter	11.5	38.1	9.7–11.8	32.5–39.7
interorbital width	2.3	7.6	2.0–2.9	6.8–9.9
jaw length	14.3	47.3	13.3–14.8	45.7–50.4
caudal-peduncle length	19.2		17.1–20.8	
caudal-peduncle depth	6.0		5.0–5.9	
dorsal-fin base	13.9		12.5–14.8	
dorsal-fin height	21.7		20.1–24.9	
adipose-fin length	3.2		1.7–3.7	
anal-fin base	7.4		7.4–9.4	
anal-fin height	9.5		7.4–9.2	
caudal-fin length (upper lobe)	20.2		18.9–21.9	
pectoral-fin length	17.7		16.5–19.4	
pelvic-fin length	20.3		17.5–21.4	

Live coloration (Fig. 2). Opalescent white with pale olive brown dorsum, scales on nape and back with slightly darker margins; underside of abdomen and caudal peduncle posterior to interpelvic area tan (Fig. 2). Dorsal fin white basally and distally, separated by pale grey and with distinctive, distally flaring, black leading edge. Anal fin white. Caudal fin grey with white ventral margin and tip to lower lobe, white dorsal margin basally on upper lobe and black dorsal edge on upper lobe distally. Pectoral fins translucent with slightly grey cast. Pelvic fins white with grey cast centrally.

Males as in female holotype, but with black tip to dorsal fin extended as narrow black distal fin margin posteriorly, and broad posteriorly tapering black band on pelvic fin running from base of outer rays to posteromesial corner distally, its lateral edge bordered by pink hue distally.

Etymology. *melanogrammus*, from the Greek *melano*, meaning "black", and *gramme*, for "line", in reference to the distinctive black leading edge of the dorsal fin in this species.

Distribution. Known only from eastern Australia, from just north of Townsville, Queensland (17°48'S) to Newcastle, New South Wales (32°50'S), in depths of 184–606 m.

Discussion. Despite the poor historical understanding of the diversity of this genus in Australasian waters, species occurring in this part of the world may be easily distinguished by a number of obvious features (see Diagnosis). As with other Australian *Paraulopus, P. melanogrammus* n.sp. can be recognized by coloration alone. It is the only Australian *Parulopus* with black basal and distal extremes, if not the entire leading edge of the dorsal fin. In other species, black pigmentation on the dorsal fin is confined to the dorsal margin.

Within the *Paraulopus nigripinnis* complex, this species shares three rows of cheek scales with *P. nigripinnis, P. novaeseelandiae* and *P. okamurai*, whereas "*Paraulopus* n. sp. 1" and "*Paraulopus* n. sp. 2" of Sato, Gomon & Nakabo (in prep.), have only two. It shares, however, a low number of predorsal scales with the other three continental Australian species belonging to the *P. nigripinnis* complex (12–14, versus 17–18), and modally 16 (versus 17–18) pectoral-fin rays with *P. nigripinnis*. Despite the presence of a number of variable characters in species of this complex, the distribution of character states does not indicate clear relationships.

Like most if not all representatives of the complex, sexual dichromatism is present, manifested in this species in the pigmentation of the dorsal, pelvic and probably caudal fins, as detailed above. The most obvious feature is the dark banding on the pelvic fin of males, which is absent in females.

Although certainly not allopatric, Australian species of *Paraulopus* generally do not have broadly overlapping distributions. The one exception is *P.* n.sp. 2 which is found in more than half of the region occupied by *P. nigripinnis*. *Paralopus melanogrammus* overlaps slightly with *P. nigripinnis* to the south and a slender species of the *Paraulopus oblongus* complex (*sensu* Sato & Nakabo, 2003) in the north.

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Rhinobatos sainsburyi n.sp. and *Aptychotrema timorensis* n.sp. —Two New Shovelnose Rays (Batoidea: Rhinobatidae) from the Eastern Indian Ocean

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ABSTRACT. Two new shovelnose rays, *Rhinobatos sainsburyi* n.sp. and *Aptychotrema timorensis* n.sp., are described from the continental shelf off northwestern Australia. *Rhinobatos sainsburyi* belongs to an unresolved supraspecific complex that includes the type of the genus, *R. rhinobatos* (Linnaeus), and at least 9 other species that occur in the Indo-Pacific. *Rhinobatos sainsburyi* differs from these species by a combination of morphometry, squamation and colour. *Aptychotrema timorensis*, a third valid member of an endemic Australian genus, differs from its congeners in morphometry, and in having a narrower snout apex, fewer caudal vertebrae, and white spots on its dorsal surface.

LAST, PETER R., 2004. *Rhinobatos sainsburyi* n.sp. and *Aptychotrema timorensis* n.sp.—two new shovelnose rays (Batoidea: Rhinobatidae) from the eastern Indian Ocean. *Records of the Australian Museum* 56(2): 201–208.

In 1978 the Commonwealth Scientific and Industrial Research Organisation (CSIRO) initiated a decade long research program to investigate fish community structure off northwestern Australia to assist in the management of a Taiwanese trawl fishery in the area. As the fish fauna was poorly known at that time, the initial phase of the field-based program focused on describing the fauna and its distribution. An emphasis was placed on the consistent and accurate identification of species across all surveys. Specimens were photographed fresh and identifying features noted to produce dossiers for each species. Dossiers were assembled by family-group into durable 6 ring-bound folders for use at sea. This reference was used to refresh the identification skills of field staff before each cruise and was upgraded and enhanced as additional material was examined. This work led to the publication of a field guide to the main demersal shelf fishes of north and northwestern Australia (Sainsbury *et al.*, 1985). The program also led to the discovery of many new fishes, including new elasmobranchs. Two new species of shovelnose rays (Rhinobatidae), caught during these surveys, are described and figured below.

Materials and methods

Morphometrics follow a standard developed for the family at a recent FAO-funded workshop on batoid morphological and meristic techniques (Paris, March 2002) and explained in Last *et al.* (2004). Specific measurements of the nasal region of *Rhinobatos* include the three main circum-nasal structures: an anterior nasal flap (nasal valve of Norman, 1926) bordering the inner margin of the nostril; a posterolateral nasal flap originating along the lateral margin of the anterior (incurrent) aperture and extending variably along the lateral margin of the nostril; and a posterior nasal flap mainly bordering the posterior (excurrent) nasal

Plate 1. (*a*) Dorsal view of the holotype of *Aptychotrema timorensis* n.sp. (CSIRO CA1258), 582 mm TL, female, Timor Sea, eastern Indian Ocean. (*b*) Dorsal view of the holotype of *Rhinobatos sainsburyi* n.sp. (CSIRO H.4041-04), 506 mm TL, mature male, off northwestern Australia, eastern Indian Ocean.

aperture. Measurements follow methods widely used for sharks (Compagno, 1984) with refinements, including: snout length—direct length from the snout tip to the bony nasal capsule adjacent the orbit (forward of eye socket); spiracle length—greatest length of the main cavity; preoral length—direct length from the snout to the posterior edge of upper jaw at its symphysis; mouth width—taken across the exposed width; and, pelvic-fin insertion to dorsal-fin origin—horizontal distance from the pelvic base to the origin of the first dorsal-fin. Meristics were taken mainly from radiographs; nasal lamellae counts were taken from the posterior half of the nasal capsule where possible. Comparative material included three specimens of *R. hynnicephalus*: HUMZ 34844, adolescent ♂, 489 mm TL; HUMZ 66224, ♀, 602 mm TL; and HUMZ 109478, ♀, 476 mm TL. Types are held in the ichthyological collection of the CSIRO, Hobart (CSIRO). Other institutional abbreviations follow Leviton *et al.* (1985).

Aptychotrema timorensis n.sp.

Figs. 1,2, Plate 1*a*, Table 1

Aptychotrema sp.—Gloerfelt-Tarp & Kailola, 1984: 31, fig. (of CSIRO CA1258).

Aptychotrema sp. 2.—Sainsbury *et al.*, 1985: 44–45, fig. (of CSIRO CA1258).

Aptychotrema sp. A.—Last & Stevens, 1994: 284, 285, pl. 40, figs. (of CSIRO CA1258).

Type material. HOLOTYPE: CSIRO CA1258, female, 582 mm TL, 10°14'S 130°03'E, north of Bathurst Island, Northern Territory, 124 m, 8 Jul. 1980.

Diagnosis. An *Aptychotrema* distinguished by the following combination of characters: disc relatively large, broadly wedge-shaped, with a narrowly pointed snout; orbit diameter equal to interorbital width; tail short, about 1.1 times precloacal length; mouth small, precloacal length about 8 times mouth width; first dorsal-fin short, length 6% TL, about 2.3 times in interdorsal distance; dorsal-fin apices angular; caudal fin short, dorsal margin 12% TL; pelvic fin large, length about 2.8 times width; post-synarcual vertebral centra 156; nasal lamellae 27; ventral tip of snout not black-tipped; and dorsal surface covered with small, white spots.

Description. Disc broadly wedge shaped, angular anteriorly, angle anterior to eyes about 55°; outer margins broadly rounded, narrowly rounded distally, length 1.31 times width. Pelvic fins elongate, long-based, base length 1.46 times inner margin; total length 1.58 times their base length, 2.78 times width; anterior margin weakly convex, apex broadly rounded, posterior margin almost straight. Tail depressed, broad anteriorly, tapering; in cross-section nearly flat below, rounded above; tail length from anterior cloaca 1.14 times precloacal length, 1.11 times disc length, 5.51 times width at pelvic-fin insertions; tail width 2.20 times depth at pelvic-fin insertions, 1.89 at first dorsal-fin origin, 1.72 at second dorsal-fin origin. Dermal fold lateral on tail, originating about eye diameter behind free rear tip of pelvic fin, reaching just behind ventral caudal-fin origin; fold moderate, its width uniform along interdorsal space.

Head long, ventral length 29.7% TL; snout moderately long and bluntly pointed; preoral snout length 3.42 times mouth width, 6.93 times internarial distance, 1.65 times dorsal caudal-fin margin, 5.18 times distance from nostril to margin of disc; preorbital snout length (direct) 3.19 times interspiracular length, 5.21 times orbital diameter, 5.26 times interorbital width; interorbital space slightly concave, width moderate; eyes moderately small, not elevated or protruding, orbital diameter 1.51 times spiracle length, 1.01 times interorbital width. Spiracle subrectangular, size moderate; no folds on posterior margin. Nostril small, transverse, nasal flaps moderately developed; anterior aperture oval, width exceeding length; nostril length 2.39 times anterior aperture width, 1.53 times anterior nasal-flap base length, 0.65 times in distance from nostril to edge of disc, 0.87 times internarial distance. Anterior nasal flap narrow with long, slender process anteriorly, tapering with crenulate margin posteriorly; flap base 1.45 times its width at process, 1.56 times anterior aperture width; inserted near innermost margin of nostril; distance between insertions of flaps 2.87 in greatest distance across nostrils, 1.10 in minimum internarial distance; process of flap about twice as long as wide, bluntly pointed distally, weakly overlapping posterolateral nasal flap and determining posteromesial margin of anterior aperture. Posterolateral nasal flap lobe-like, broadest anteriorly, length 3.73 times width; originating at lateral extremity of anterior nasal aperture, extending posteromesially as a free fold almost to innermost edge of nostril. Posterior nasal flap weakly lobe-like laterally, base length 4.52 times its width, reaching innermost margin of nostril as thin fold; width 0.46 of anterior aperture width, 0.83 of posterolateral nasal-flap width. Nasal lamellae 27. Mouth narrow, width 2.34 times nostril length, 8.03 in precloacal length; positioned over hind margin of orbit; jaws strong, thick. Upper jaw strongly convex, arched; deep preoral groove demarcating upper lip, strongly arched, following profile of upper jaw; lower lip pronounced, postoral groove well developed, no ridges of strongly corrugated skin on chin; weak, short lateral grooves around corners of mouth. Teeth small, blunt, crowns rhomboidal with weak, pointed posterior cusps; teeth quincuncial, about 76 rows in upper jaw; upper and lower jaw teeth similar in shape and size. Gill openings s-shaped, fifth less so; length of third gill slit 1.60 in nostril length, 6.07 in distance between fifth gill slits; distance between first gill slits 1.43 times distance between fifth gill slits; distance between fifth gill slits 3.28 times internarial distance, 1.62 times mouth width, 0.32 of ventral head length.

Dorsal-fins moderately upright, apices angular; anterior margins weakly convex, posterior margins almost straight; free rear tips forming right angle, not produced; first dorsal-fin slightly taller than second, length of first 0.94 times its height, base length 1.87 times inner margin length; second dorsal-fin length 1.10 times its height, base length 2.26 times inner margin length. First dorsal-fin well behind pelvic-fin insertion, interspace 1.28 times interdorsal distance; interdorsal space relatively short, 1.56 times second dorsal-fin height, 2.29 times base of first dorsal-fin, 1.59 times interspace between second dorsal-fin insertion and upper origin of caudal fin; 1.45 times tail width at first dorsal-fin origin. Caudal fin relatively small, short, dorsal caudal margin 2.02 times preventral margin length.

Dermal denticles small, close-set, covering entire body and fins; surfaces uniform, coarsely granular but becoming enlarged slightly in some regions; slightly enlarged mid-dorsally on disc and tail. Thorns present around preorbit, postorbit, spiracle, scapular region and along dorsal midline;

Fig. 1. Ventral view of the snout of the holotype of *Aptychotrema timorensis* n.sp. (CSIRO CA1258).

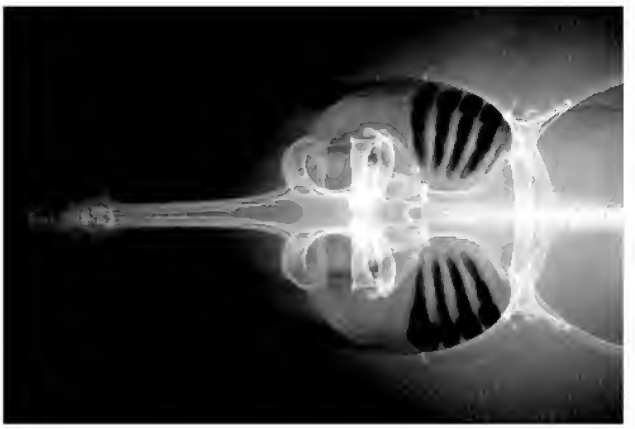

Fig. 2. Radiograph of the chondrocranium of the holotype of *Aptychotrema timorensis* n.sp. (CSIRO CA1258).

mostly of similar size, crowns very short, globular, tips mostly blunt; bases embedded; single row of irregularly, mostly widely, spaced thorns extending from just behind head to near origin of first dorsal-fin; evident as enlarged denticles on interdorsal midline; median thorns uniform in size, about 29 in single series; two widely separated scapular thorns on each side, their sizes variable but similar to those of dorsal midline; pair of slightly enlarged globular denticles near snout tip.

Prebranchial sensory pore patch indistinct, extending posteriorly to first gill slit. Postscapular sensory canals deeply embedded, not undulated anteriorly, almost reaching pectoral-fin insertions; sensory pores not evident; sensory canal not forming a shallow groove.

Rostral cartilage moderately robust, weakly constricted near midlength, length about 64% of length of neurocranium; rostral appendix expanded, narrowly rounded apically, posterior margin short, strongly concave. Precerebral anterior fontanelle broad, acorn-shaped, extending forward from just posterior to rostral base to rostral appendix; dorsal edges of fontanelle well defined, narrowly separated near base, becoming considerably more constricted anteriorly; ventral edges not detectable; cranial roof lacking posterior fontanelle. Nasal capsules small, ovoid, length shorter than width, their transverse axes laterally directed; width across nasal capsules 1.2 times nasobasal length of cranium (base of rostrum to occipital condyles); basal plate moderate, its minimum width about 4.5 times in nasobasal length. Antorbital cartilage sickle-shaped, elongate, curved posteriorly; junction with nasal capsule relatively narrow, at posterolateral margin; its lateral extension greatly exceeding length of nasal aperture; apex bluntly pointed, margin not truncate or concave; without an anterior process. Postorbital process poorly developed, width across process 1.40 times in nasobasal length; preorbital process weak.

Pectoral skeleton with 19–20 propterygial, 7 mesopterygial, 3–4 neopterygial, 26–28 metapterygial, 56–58 total radials; anterior radials of propterygium falling slightly short of nasal capsules. Total pelvic radials 24; one greatly enlarged radial on the puboischiadic bar; 23 basipterygial radials. Vertebral column with 165 total centra (synarcual and free), 156 post-synarcual centra; 9 synarcual centra; 28 monospondylous precaudal centra, all except last two with ribs; 91 diplospondylous precaudal centra, 37 diplospondylous caudal centra.

Live coloration. Dorsal surface brownish with a scattering of pale, widely spaced spots, extending from eye to caudal fin; spots smaller than pupil of eye, often with dusky outer borders; spots paired on shoulder, above pectoral- and pelvic-fin insertions, before first dorsal-fin, on anterior bases of pelvic and dorsal fins, and near free rear tip of pectoral fins. Uniformly pale ventrally; no dark markings on snout tip.

Size. To at least 582 mm TL.

Etymology. Named after the type locality of this poorly known species (i.e. the Timor Sea). Spotted shovelnose ray is the most regularly used common name.

Distribution. Timor Sea, off Melville Island (Northern Territory) at about 120 m depth.

Remarks. Members of the Australian endemic genus *Aptychotrema*, which are distinct from all other rhinobatids, are in need of revision as published data are limited for all species. They possess the following characters that may prove useful in defining the group: no internasal flap; deep preoral groove present; jaws strongly arched in both sexes; small, transverse nostrils with fewer lamellae and ovoid nasal capsules; anterior nasal flap inserted near posterior extremity of nostril, at margin or penetrating slightly into internarial space; posterior nasal flap extending to posterior extremity of nostril; rostral cartilages well-separated basally, constricted anteriorly; prebranchial sensory pore patch obscure, extending posteriorly to first gill slit; postscapular sensory canal long; no spiracular folds; and antorbital cartilage of chondrocranium elongate, sickle-shaped with a bluntly pointed apex and no anterior process.

This ray was first documented by Sainsbury *et al.* (1985) who had difficulties identifying it to a species. Its status as an unnamed taxon was initially confirmed by the author in Gloerfelt-Tarp & Kailola (1984) and later by Last & Stevens (1994). Two other nominal species, *A. rostrata* (Shaw & Nodder) and *A. vincentiana* (Haake), are currently recognized as valid (Last & Stevens, 1994). These species, which are similar to each other in appearance, have either a plain dorsal surface or are covered by large, dusky blotches rather than white spots. One of these, *A. vincentiana*, is partially sympatric with *A. timorensis*. As well as having a

Table 1. Morphometrics for holotype (CSIRO CA1258) of *Aptychotrema timorensis* n.sp. and holotype (CSIRO H.4041-04) and five paratypes (CSIRO H.757-01, H1050-03, H1091-01, H1091-03, H1091-04) of *Rhinobatos sainsburyi* n.sp. Values are expressed as a percentage of total length, TL.

	A. timorensis	*R. sainsburyi*		
	holotype	holotype	paratypes	
			min	max
total length, TL (mm)	582	506	376	557
disc width—maximum)	36.7	29.5	31.1	31.9
disc length	48.0	38.2	39.2	40.5
head length—dorsal)	23.8	19.6	18.8	20.8
head length—ventral)	29.7	24.7	23.3	26.7
snout length—presocket)	17.7	13.9	13.1	14.7
orbit diameter	3.4	4.2	3.7	4.1
spiracle length	2.2	2.2	2.3	2.4
orbit and spiracle length	4.6	4.7	4.6	4.9
interorbital width	3.4	3.0	3.3	3.9
interspiracular width	5.6	5.4	5.2	5.8
preoral length	19.9	16.4	15.5	17.9
mouth width	5.8	5.6	5.0	5.4
prenarial distance	16.4	12.2	12.0	13.6
nostril length	2.5	4.1	3.5	4.0
anterior aperture—width)	1.0	1.2	1.0	1.2
anterior nasal flap—base length)	1.6	2.6	2.4	2.7
anterior nasal flap—width)	1.1	1.7	1.4	1.5
posterolateral nasal flap—total length)	2.2	3.4	3.2	3.4
posterolateral nasal flap—width)	0.6	0.7	0.6	0.8
posterior nasal flap—base length)	2.2	3.2	2.7	3.0
posterior nasal flap—width)	0.5	1.2	0.9	1.0
distance across anterior nasal apertures	7.5	8.5	8.2	9.0
internarial distance—minimum)	2.9	2.5	2.3	2.6
distance between anterior nasal flaps	2.6	2.3	2.0	2.2
distance from nostril to disc margin	3.8	2.8	2.8	3.4
third gill opening—width)	1.5	1.3	1.2	1.4
distance between first gill openings	13.4	11.6	11.6	12.8
distance between fifth gill openings	9.4	8.5	8.8	9.3
pelvic fin—length	17.6	13.7	14.3	15.2
pelvic fin—anterior margin length	9.5	8.9	8.5	8.8
pelvic fin—width	6.3	5.7	5.2	5.8
pelvic fin—base length	11.2	6.9	7.4	9.4
pelvic fin—inner margin length	7.6	8.4	5.9	6.9
first dorsal fin—length	6.0	7.7	7.2	7.6
first dorsal fin—anterior margin length	9.1	11.4	10.8	11.6
first dorsal fin—height	6.3	8.1	7.6	7.9
first dorsal fin—base length	4.0	4.8	4.8	5.0
first dorsal fin—inner margin length	2.1	2.7	2.5	2.8
second dorsal fin—length	6.5	7.4	7.3	7.5
second dorsal fin—anterior margin length	8.9	10.5	10.0	10.6
second dorsal fin—height	5.9	7.3	6.6	7.2
second dorsal fin—base length	4.6	4.9	5.0	5.2
second dorsal fin—inner margin length	2.0	2.3	2.0	2.4
caudal fin—dorsal margin	12.0	14.1	13.7	14.6
caudal fin—preventral margin	6.0	6.6	6.5	7.0
snout to first dorsal-fin origin	64.6	53.5	54.3	55.8
snout to second dorsal-fin origin	78.0	73.3	72.6	73.8
snout to upper caudal-fin origin	87.6	85.8	85.1	86.4
snout to lower caudal-fin origin	89.7	87.4	86.7	87.7
snout to pelvic-fin origin	41.9	34.8	35.2	36.8
snout to anterior vent	46.7	37.5	38.9	40.5
pelvic-fin insertion to dorsal-fin origin	11.7	10.7	10.0	11.1
interdorsal distance	9.2	14.5	13.2	13.4
caudal peduncle length—dorsal)	5.8	7.5	7.6	8.0
body width—pelvic insertion (tail)	9.7	10.7	10.1	11.0
disc width—anterior orbit	17.8	16.5	16.6	18.2
body width—first dorsal-fin origin	6.3	10.7	9.8	11.0
body width—second dorsal-fin origin	3.8	5.3	5.2	5.7
body depth—maximum (scap)	4.9	5.5	4.6	5.2
body depth—pelvic-fin insertion	4.4	4.8	4.5	5.0
body depth—first dorsal-fin origin	3.4	4.2	3.8	4.1
body depth—second dorsal-fin origin	2.2	2.6	2.5	2.7

more broadly rounded snout apex, *A. vincentiana* appears to have a relatively smaller disc (length 42–43% vs 48% TL in adults), slightly smaller orbit (interorbital width 1.1–1.4 vs 1.0 times orbit diameter); longer tail (length 1.2–1.5 vs 1.1 times precloacal length); larger mouth (precloacal length 6.5–6.9 vs 8.0 times mouth width); longer first dorsal-fin (horizontal length 7.1–7.4% vs 6.0% TL, about 1.7–2.0 vs 2.3 times in interdorsal distance); less angular dorsal-fin apices; longer caudal fin (dorsal margin 14–15% vs 12% TL); and smaller pelvic fin (length 2.3–2.6 vs 2.8 times width). *Aptychotrema rostrata* and *A. vincentiana* typically have a dark marking at the ventral apex of the snout that is lacking in *A. timorensis*. The smaller caudal fin of *A. timorensis* is evidenced by fewer vertebral centra (caudal centra 37 vs 39–44 in *A. rostrata* n = 9, and 42–46 in *A. vincentiana*, n = 18).

Rhinobatos sainsburyi n.sp.

Figs. 3,4, Plate 1*b*, Table 1

Rhinobatos sp. 1.—Gloerfelt-Tarp & Kailola, 1984: 29, fig. (CSIRO CA2863, NW of Port Hedland, Western Australia).
Rhinobatos sp. 4.—Gloerfelt-Tarp & Kailola, 1984: 30, fig. (CSIRO CA1257, NE of Monte Bello Is, Western Australia).
Rhinobatos sp. 1.—Sainsbury *et al.*, 1985: 44, pl. (CSIRO CA2863, NW of Port Hedland, Western Australia).
Rhinobatos sp. 2.—Sainsbury *et al.*, 1985: 44, pl. (CSIRO CA1257, NE of Monte Bello Is, Western Australia).
Rhinobatos sp. A.—Last & Stevens, 1994: 284, 289, pl. 39, figs.

Type material. HOLOTYPE: CSIRO H.4041-04, mature male, 506 mm TL, 19°29'S 117°35'E, NE of Cape Lambert, Western Australia, 70 m, 1 Sep. 1995. PARATYPES: CSIRO CA1129, ♀, 490 mm TL, 18°38'S 119°19'E, NE of Bedout Island, Western Australia, 125 m, 6 Jun. 1980; CSIRO CA3901, mature ♂, 489 mm TL, 18°54'S 117°44'E, NW of Port Hedland, Western Australia, 148 m, 30 Jan. 1983; CSIRO H.743-01, ♀, 595 mm TL, 20°19'S 115°03'E, west of Monte Bello Islands, Western Australia, 92 m, 12 Oct. 1986; CSIRO H.757-01, immature ♂, 376 mm TL, 19°00'S 118°03'E, NW of Port Hedland, Western Australia, 116 m, 22 Oct. 1986; CSIRO H.1048-01, mature ♂, c. 460 mm TL, 18°37'S 118°20'E, south of Rowley Shoals, Western Australia, 137 m, 25 Sep. 1987; CSIRO H.1050-03, ♀, 542 mm TL, 18°52'S 118°38'E, north of Port Hedland, Western Australia, 100 m, 26 Sep. 1987; CSIRO H.1058-02, ♀, 434 mm TL, 19°04'S 118°11'E, NW of Port Hedland, Western Australia, 86 m, 26 Sep. 1987; CSIRO H.1090-01, ♀, 532 mm TL, 19°38'S 117°06'E, north of Nickol Bay, Western Australia, 70 m, 3 Oct. 1987; CSIRO H.1091-01, ♀, 530 mm TL, 19°53'S 116°06'E, NW of Dampier Archipelago, Western Australia, 66 m, 4 Oct. 1987; CSIRO H.1091-03, ♀, 503 mm TL, 19°53'S 116°06'E, NW of Dampier Archipelago, Western Australia, 66 m, 4 Oct. 1987; CSIRO H.1091-04, ♀, 557 mm TL, 19°53'S 116°06'E, NW of Dampier Archipelago, Western Australia, 66 m, 4 Oct. 1987; CSIRO CA1253, mature ♂, 531 mm TL, 9°52'S 129°14'E, north of Joseph Bonaparte Gulf, Northern Territory, 158 m, 9 Jul. 1980.

Diagnosis. A *Rhinobatos* distinguished by the following combination of characters: disc wedge-shaped, its dorsal surface scaled but without thorns; snout short, snout length

Fig. 3. Ventral view of the snout of the holotype of *Rhinobatos sainsburyi* n.sp. (CSIRO H.4041-04).

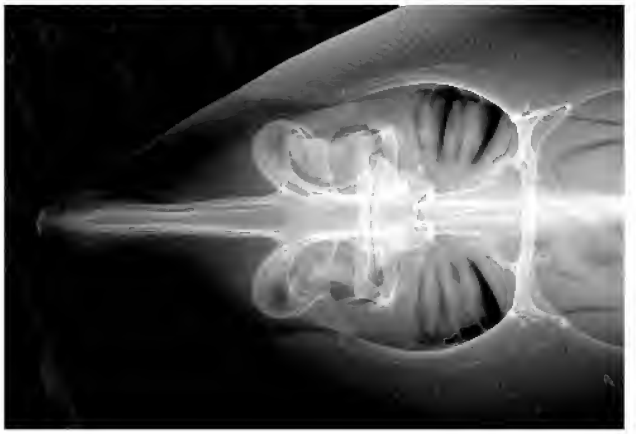

Fig. 4. Radiograph of the chondrocranium of the holotype of *Rhinobatos sainsburyi* n.sp. (CSIRO H.4041-04).

2.5–2.6 times interspiracular distance; orbit moderately large, diameter 1.6–1.9 times spiracle length; nostrils oblique, length 1.4–1.6 times internarial distance; anterior nasal-flaps inserted well into internarial space, but never almost united near ventral midline; posterior nasal flaps broad; ridges of rostral cartilage well-separated dorsally and almost parallel; prebranchial sensory-pore patch narrow, extending to first gill slit; distance between first gill slits 1.3–1.4 times distance between fifth gill slits; distance between fifth gill slits 2.5–2.9 times in ventral head length; postscapular sensory canal long, not grooved, extending more than three-quarters distance to pectoral-fin insertions; moderately tall dorsal-fins; pelvic-fin inner margin distinctly longer than its base in mature males but shorter than base in females; interdorsal distance more than 2.5 times first dorsal-fin base; outer spiracular fold distinctly larger than inner fold; dorsal margin of caudal fin about 2.0–2.2 times preventral margin; 162–171 post-synarcual vertebral centra; about 50 nasal lamellae; and dorsal disc plain brownish or with faint dusky blotches or fine dark spots.

Description. Disc wedge shaped, angular anteriorly, angle anterior to eyes about 66°; outer margins broadly rounded, narrowly rounded distally, length 1.29 in mature ♂ holotype (1.24–1.29 in 5 paratypes) times width (Table 1). Pelvic fins relatively short, relatively short-based in mature ♂, base length about 0.82 of inner margin (much longer in paratypes, 1.07 times in young ♂ paratype, 1.22–1.60 times in 4 ♀ paratypes); total length 1.98 (1.92 and 1.60–1.81) times their base length, 2.42 (2.64–2.85) times width; anterior margin weakly double concave, apex broadly rounded, posterior margin convex. Tail slender; in cross-section nearly flat ventrally, rounded dorsally; tail length from anterior cloaca 1.67 (1.47–1.57) times precloacal length, 1.64 (1.47–1.55) times disc length, 5.83 (5.43–6.02) times body width at pelvic-fin insertions; tail width 2.23 (2.16–2.28) times depth at pelvic-fin insertions, 2.53 (2.40–2.73) at first dorsal-fin origin, 2.02 (2.04–2.32) at second dorsal-fin origin. Dermal fold ventrolateral on tail, originating slightly anterior to free rear tip of pelvic fin, reaching just behind ventral caudal-fin origin; fold well developed, maximum width in interdorsal space about a half width of posterior nasal flap.

Head rather short, ventral length 24.7% (23.3–26.7%) TL; snout short and narrowly rounded; preoral snout length 2.95 (2.98–3.29) times mouth width, 6.59 (5.98–7.25) times internarial distance, 1.16 (1.09–1.23) times dorsal caudal-fin margin, 5.78 (4.80–5.76) times distance from nostril to margin of disc; snout length (direct) 2.60 (2.46–2.59) times interspiracular length, 3.31 (3.30–3.58) times orbit diameter, 4.61 (3.74–4.06) times interorbital width; interorbital space almost flat, rather narrow; eyes moderately small, not elevated or protruding, relatively larger in mature ♂, orbit diameter 1.90 (1.59–1.77) times spiracle length, 1.39 (1.06–1.15) times interorbital width. Spiracle lunate, moderately large; two weakly compressed spiracular folds on posterior margin, innermost fold half or less length of outer fold; distance between bases of folds subequal to length of inner fold. Nostril moderately large, oblique, nasal flaps well developed; anterior aperture subrectangular to ovoid, width well exceeding length; nostril length 3.47 (3.01–3.54) times anterior aperture width, 1.56 (1.37–1.56) times anterior nasal-flap base length, 1.44 (1.04–1.27) times distance from nostril to edge of disc, 1.64 (1.37–1.63) times internarial width. Anterior nasal flap broad with long, bluntly pointed process anteriorly; flap base 1.56 (1.67–1.94) times its width at process, 2.22 (2.02–2.45) times anterior aperture width; inserted well into internarial space, not at nostril margin, distance between their insertions 3.75 (3.73–4.51) in distance between lateral margins of anterior apertures, 1.09 (1.07–1.24) in internarial width; process of flap about twice as long as wide at its base, overlapping posteromesial edge of posterolateral nasal flap and determining inner margin of anterior aperture. Posterolateral nasal flap lobe-like, width uniform along most of hind margin of anterior aperture, length 4.78 (4.38–5.68) times width; originating at lateral extremity of anterior nasal aperture, extending posteriorly as free fold (below anterior fold and above posterior fold along lateral margin of nostril) to about level of insertion of anterior nasal flap. Posterior nasal flap strongly lobate, base length 2.57 (2.72–3.18) times its width, not reaching end of nostril, inserted well forward of posterior tip; width subequal to anterior aperture width, 1.74 (1.22–1.65) times posterolateral nasal-flap width. Nasal lamellae 51. Mouth moderately wide, width 1.36 (1.37–1.46) times nostril length, 6.73 (7.33–7.78) in precloacal length; positioned just in advance of hind margin of orbit; jaws not greatly thickened. Upper jaw weakly double concave, upper lip arched slightly, no preoral groove; lower lip pronounced,

not separated from post-oral groove by ridges of strongly corrugated skin; weak lateral grooves around corners of mouth. Teeth small, blunt, crowns rhomboidal with weak, pointed posterior cusps; teeth quincuncial, about 80 rows in upper jaw; upper and lower jaw teeth similar in shape and size. Gill openings weakly s-shaped (apart from fifth); length of third gill slit 3.18 (2.68–2.96) in nostril length, 6.63 (6.72–7.10) in distance between fifth gill slits; distance between first gill slits 1.35 (1.26–1.41) times distance between fifth gill slits; distance between fifth gill slits 3.42 (3.47–4.09) times internarial distance, 1.53 (1.67–1.82) times mouth width, 2.51–2.94 times in ventral head length.

Dorsal-fins of moderate size, relatively upright; semi-falcate, apices narrowly rounded rather than angular; anterior margins convex distally, posterior margins concave; free rear tips forming right angle; first dorsal-fin marginally taller than second, length of first 0.95 (0.92–1.00) times its height, base length 1.79 (1.72–1.88) times inner margin length; second dorsal-fin length 1.02 (1.02–1.11) times its height, base length 2.12 (2.04–2.58) times inner margin length. First dorsal-fin relatively close to pelvic-fin insertion, interspace 0.74 (0.75–0.83) times interdorsal distance; interdorsal space relatively short, 2.00 (1.86–2.01) times second dorsal-fin height, 3.04 (2.68–2.79) times base of first dorsal-fin, 1.94 (1.66–1.77) times interspace between second dorsal-fin insertion and upper origin of caudal fin. Caudal fin small, dorsal caudal margin 2.13 (1.97–2.19) times preventral margin length. Mature clasper slender, relatively short, inner length of right clasper about 13% TL (left malformed in holotype); tip acute, glans weakly expanded.

Dermal denticles minute, close-set, covering entire body; posterior portions of dorsal and caudal fins naked; thorns and tubercles absent; dorsal surface with narrow series of slightly enlarged, flat-top denticles around eye, along midline, and on scapular; these denticles most pronounced before eye and in nuchal and prenuchal regions; preorbital patch strongly demarcated from those covering orbit. Ventral surface uniformly covered in minute denticles, including upper lip edges, near insertion of anterior nasal flap, below posterolateral and posterior nasal flaps, and on tail beneath pelvic fins, and most of claspers.

Prebranchial sensory pore patch relatively narrow, extending posteriorly to level of first gill slit. Postscapular sensory canal long, not undulated anteriorly, terminating about an eye diameter from pectoral-fin insertions; canal deeply embedded, not forming shallow groove; sensory pores originating anteriorly from very short branches derived from main canal, pores becoming confluent with canals posteriorly.

Rostral cartilage broad, relatively short, length about 61% of length of neurocranium; rostral appendix expanded, broadly rounded apically, posterior margin long, weakly concave. Precerebral anterior fontanelle broad, extending forward from just posterior to rostral base to rostral appendix; dorsal edges of fontanelle well defined, widely separated, almost parallel; ventral edges almost united anteriorly, more constricted than dorsal edges; cranial roof with small oval posterior fontanelle, located well behind precerebral fontanelle. Nasal capsules moderately large, their transverse axes anterolaterally directed; width across nasal capsules 1.20 times nasobasal length of cranium (base of rostrum to occipital condyles); length of nasal capsule about equal to its width; basal plate narrow, its minimum width 4.52 times in nasobasal length. Antorbital cartilage subtriangular, short; junction with nasal capsule broad, posterolateral; lateral extension short, equal to or shorter than length of nasal aperture; apex blunt, margin truncate to concave, without anterior process. Postorbital process well developed, bifurcate, posterior extension very pronounced, width across process 1.51 times in nasobasal length; preorbital process well developed.

Pectoral skeleton with 29–31 (25–31, in 10 paratypes) propterygial, 6 (6–8) mesopterygial, 1 (1–3) neopterygial, 25–27 (25–27) metapterygial, 61–65 (59–65) total radials; anterior radials of propterygium extending forward of nasal capsules by about 10.5% of rostral length. Total pelvic radials 1+24+1; first greatly enlarged, on puboischiadic bar; 24 basipterygial radials; clasper calcified. Vertebral column with 181 (175–185) total centra (synarcual and free), 168 (162–171) post-synarcual centra; 13 (12–16) synarcual centra; 23 (23–26, mainly 23–24) monospondylous centra, only last centrum of holotype without ribs; 101 (98–105) diplospondylous precaudal centra, 44 (39–45) diplospondylous caudal centra.

Live coloration. Body pale yellowish brown dorsally, with dense cover of faint dusky blotches (blotches sometimes absent or more golden in paratypes); somewhat paler near hind margin of pectoral fin; paler yellowish to white on lateral snout, anterior edge of orbit, lateral cutaneous fold of tail, and between ridges of rostral cartilage; nasal capsules not sharply demarcated from lateral snout; snout tip and fins plain. Ventral surface uniformly white; no dark tip on snout apex.

Size. To at least 595 mm TL; males mature at 460 mm but immature at 376 mm TL.

Etymology. In acknowledgment of the efforts of Dr Keith Sainsbury who planned and managed the initial trawl fish surveys of the continental shelf of northwestern Australia. His foresight in recognizing the need for documenting the fauna before attempting to address more management oriented questions is exemplary. This pioneering research has provided an excellent regional biological baseline that would otherwise be unavailable for regional marine management. Goldeneye shovelnose ray is the most regularly used common name.

Distribution. Known from northern and northwestern Australia, from the Timor Sea (NW of Melville Island, Northern Territory) south to the Monte Bello island group (North-West Shelf) in 66–200 m but mostly collected shallower than 150 m.

Remarks. *Rhinobatos sainsburyi* was initially identified as two unspecified species of *Rhinobatos* based on colour differences in two field guides (Gloerfelt-Tarp & Kailola, 1984; Sainsbury *et al.*, 1985). Some individuals are spotted and others are plain but there are no other obvious morphological differences between these forms and intermediate colour patterns exist.

This species belongs to a poorly defined subgroup of the genus *Rhinobatos* Linck characterized by having widely separated, submarginal insertions of the anterior nasal flap, and the dorsal ridges of the rostral cartilages rather well

separated and subparallel to each other. This group, which includes the type species of the genus, *R. rhinobatos* (Linnaeus), is represented in the Indian Ocean by five species, *R. rhinobatos*, *R. annandalei* Norman, *R. lionotus* Norman, *R. holcorhynchus* Norman, and *R. punctifer* Compagno & Randall, and in the western Pacific Ocean by three species, *R. schlegelii* Müller & Henle, *R. formosensis* Norman, and *R. hynnicephalus* Richardson. Recent studies (Last and others, unpublished) suggest that additional undescribed species exist in the region and the ranges of nominal taxa are smaller than first thought.

The body shape of *Rhinobatos sainsburyi* is distinct within the group. Of related species, using Norman's (1926) key, it is closest to *R. hynnicephalus* from the Japanese Archipelago, in having a snout length between 2.3–3.0 (2.5–2.6 in *R. sainsburyi*) times interspiracular distance, preoral length 2.8–3.0 (2.9–3.3) times width of mouth, small inner spiracular fold, disc with rudimentary denticles, and being pale brownish dorsally. It differs significantly, from similar-sized specimens of *R. hynnicephalus* from Japan and Taiwan (HUMZ 34844, 66224, 109478) in having a shorter snout (in adults, 13.1–13.9% vs 15.0–16.2% TL), shorter predorsal distance (53.5–55.8% vs 57.3–60% TL), and dorsal-fins relatively more widely spaced (base of pelvic fin to origin of first dorsal-fin 0.7–0.8 vs 1.0–1.2 times interdorsal distance).

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Descriptions of Six New Species of Jawfishes (Opistognathidae: *Opistognathus*) from Australia

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ABSTRACT. Descriptions of six new species of Australian jawfishes (genus *Opistognathus*) are presented: *O. alleni* n.sp. (Western Australia), *O. seminudus* n.sp. (Great Barrier Reef), *O. stigmosus* n.sp. (Great Barrier Reef and Coral Sea Plateau), *O. elizabethensis* n.sp. (Tasman Sea, Elizabeth Reef), *O. verecundus* n.sp. (northern Australia), and *O. reticeps* n.sp. (northern Australia). The nominal genus *Tandya* Whitley is discussed and provisionally synonymized with *Opistognathus* Cuvier. An identification key to all Australian jawfishes is provided.

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The jawfishes, family Opistognathidae, known from tropical waters of Australian seas include two species of *Stalix* Jordan & Snyder (Smith-Vaniz, 1989) and 15 species of *Opistognathus* Cuvier. Adults of Australian species range in size from about 30 to 409 mm SL (50 cm TL) and have been taken in depths of 0.3–66 m. These diurnal fishes are obligatory burrow-dwellers and all species appear to orally incubate their eggs, which may account for the relatively high incidence of endemism (including 12 of the 17 known Australia species) in the family. Six of these endemic Australian jawfishes are new species, all of which are described below.

Materials and methods

Methods follow Smith-Vaniz (1997) and abbreviations for institutional depositories follow Leviton *et al.* (1985). The last two elements in the dorsal and anal fins have their bases in close approximation ("split to base" condition) and were counted as one ray in accord with the general practice of most authors, although the ultimate element has a separate rudimentary pterygiophore or stay. The short, dorsalmost element in the pectoral fin is included in the ray counts. The pattern of insertion of supraneural (= predorsal) bones and anterior dorsal-fin pterygiophores referred to as "insertion pattern" in descriptions is modified from the "predorsal formula" of Ahlstrom *et al.* (1976). Neural spines are indicated by slashes, a "0" indicates an empty interneural space; supraneurals are represented by an "S" and pterygiophores bearing a single serially associated spine are represented by a "1". In material examined: cleared and stained specimens are indicated as "C&S"; unless otherwise specified, specimen sizes are given as mm standard length (SL); parenthetical expressions present number of specimens, if more than one, followed by size range.

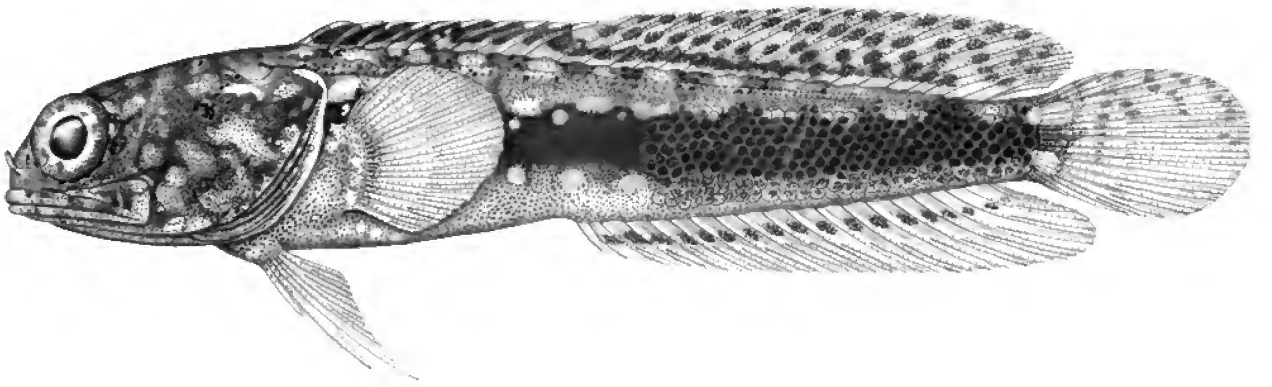

Fig. 1. *Opistognathus alleni*, paratype, WAM P.27590-002, female, 72.4 mm SL, Houtman Abrolhos Archipelago, Western Australia. Drawn by Jack R. Schroeder.

Opistognathus alleni n.sp.

Figs. 1, 2A, 3A, 4A; Tables 1–4

Opistognathus sp.—Allen & Swainston, 1988:126, pl. 54, colour fig. 814 (brief diagnosis; common name "Abrolhos jawfish").

Type material. HOLOTYPE: WAM P.27590-030, male (73.7), Western Australia, Houtman Abrolhos Archipelago, N. end of Dicks Island, in Goss Passage, 28°30'S 113°46'E, 30–32 m, G.R. Allen and N. Sinclair, 17 Apr. 1982. PARATYPES: 39 specimens, 45.4–72.4 mm, all from Western Australia. WAM P.27590-002 (11, 47.4–72.4), same data as holotype; WAM P.27587-003 (54.0), Houtman Abrolhos Archipelago, S. end Long Island, in Goss Passage, 28°29'S 113°46'E, 25–32 m, G.R. Allen, 16 Apr. 1982; AMS I.33668-001 (3, 51.4–66.1), ANSP 157594 (4, 53.8–66.2, 1 C&S), NTM S.13294-001 (3, 50.5–55.1), USNM 315663 (3, 62.7–68.7) and WAM P.27595-003 (9, 45.4–51.2), Houtman Abrolhos Archipelago, all from Long Island, in Goss Passage, 30–33 m, G.R. Allen *et al.*, 19 Apr. 1982. MPM 33192 (53.7), Exmouth Gulf, Burnside Island, 22°5'33"S 114°30'55"E, 0–0.6 m, R.D. Mooi, A.C. Gill, J.B. Hutchins and R.C. Miles, 19 May 1996. BMNH 2001.11.28.1 (45.3) and MPM 33191 (2, 40.6–46.8), Locker Island, 21°42'12"S 114°45'48"E, 0–0.2 m, R.D. Mooi, A.C. Gill and R.C. Miles, 16 May 1996. MPM 33190 (45.9), Bessieres Island, 21°31'2"S 114°45'13"E, 13–15 m, R.D. Mooi, A.C. Gill, R.C. Miles and N. Williams, 15 May 1996.

Diagnosis. A species of *Opistognathus* with dorsal fin X, 19 (rarely 20); body with about 21–31 oblique scale rows in longitudinal series, and scales absent anterolaterally forward of verticals from 6th to 9th segmented dorsal-fin rays; spinous dorsal fin with a broad dark submarginal stripe and spine tips with pale fleshy tabs; vomerine teeth 1–3.

Description. Dorsal-fin rays X, 19 (rarely 20). Anal-fin rays II, 17–18 (typically 18). Pectoral-fin rays 19 or 20. Caudal fin: procurrent rays 4–5+3–5, segmented rays 8+8, middle 12–14 branched, total elements 23–26; hypural 5 present or (usually) absent. Vertebrae: 10+22 (10+23 in one of 35 specimens); last pleural rib on vertebra 10; epineural ribs 11–15. Supraneurals absent, insertion pattern 0/0/1/1+1/1/. Gill rakers 8–10+16–18 = 24–28.

Scales absent on body anterolaterally forward of verticals from 6th to 9th segmented dorsal-fin rays, and from head, nape, area above lateral line, pectoral-fin base and breast; belly squamation varying from completely naked to posterior ¼ scaly. Body with about 21–31 oblique scale rows in longitudinal series. Lateral-line terminus below verticals from 13th to 17th segmented dorsal-fin rays (total element position 23–27). Lateral line pores numerous, arranged in multiple series above and below embedded lateral-line tubes. Cephalic sensory pores very numerous, in adults completely covering most of head, including all of predorsal area except a small area immediately adjacent

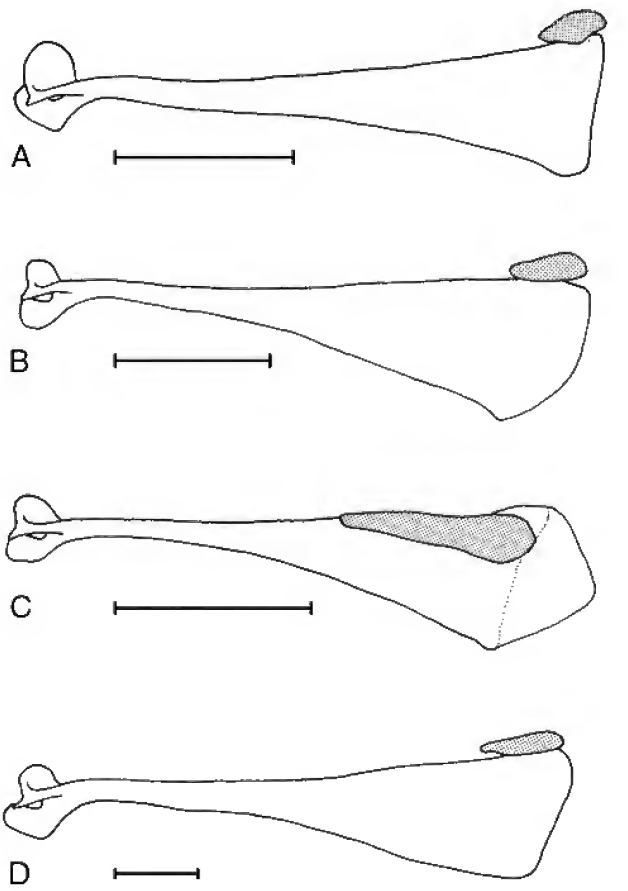

Fig. 2. Maxilla and supramaxilla (shaded): A, *Opistognathus alleni*; B, *O. seminudus*; C, *O. verecundus*; D, *O. reticeps*. Data as in figure 3; scale bars represent 2 mm.

Table 1. Frequency distributions for certain fin-ray counts in selected Australian species of *Opistognathus* (holotype values in boldface).

species	dorsal spines 10	11	12	dorsal-fin rays 14	15	16	17	18	19	20	mean	total dorsal-fin elements 25	26	27	28	29	30	mean
alleni	40								**39**	1	19.0					**39**	1	29.0
seminudus	1	**66**		4	**60**	3					15.0	4	**61**	2				26.0
stigmosus	4								4		19.0					4		29.0
elizabethensis		4						2	**2**		18.5					2	**2**	29.5
verecundus	2	**27**		**26**	3						14.1	**28**	1					25.0
reticeps			7		1	**6**					15.9			1	**6**			27.9

species	segmented anal-fin rays 13	14	15	16	17	18	19	mean	total pectoral-fin rays 36	37	38	39	40	41	42	43	44	45	46	mean
alleni					4	**36**		17.9			23	5	**12**							38.7
seminudus		**51**	16					14.2			3	4	30	12	**15**					40.5
stigmosus						4		18.0				1	**2**	—	1					40.2
elizabethensis					1	2	**1**	18.0			**1**	—	2	1						39.7
verecundus	1	**27**	1					14.0	**15**	6	8									36.8
reticeps	1	**7**						13.9									**6**	—	2	44.5

to dorsal-fin origin; mandibular pore positions 1–3 occupied by relatively large, single pores, 4th position with 6–12 pores, 5th position with 19–30.

Anterior nostril distinctly closer to posterior nostril than to dorsal margin of upper lip, and with a simple, flattened tentacle on posterior rim that when depressed reaches margin of orbit; height of tentacle about 1.5 to 2.0 times maximum diameter of posterior nostril. Dorsal fin very low anteriorly, gradually increasing in height posteriorly; profile relatively uniform with only a slight change in fin height at junction of last spine and anterior segmented rays. Dorsal-fin spines relatively short and straight, at most only slightly curved distally and without flexible tips; skin covering tips of spines with slightly swollen fleshy tabs; all segmented dorsal- and anal-fin rays branched distally. Outermost segmented pelvic-fin ray not tightly bound to adjacent ray, interradial membrane incised distally. Upper margin of opercle straight and slightly rounded posterodorsally; posterior margin of preopercle indistinct, without a free margin. No papillae on inner surface of lips. Fifth cranial nerve passes under A1β section of adductor mandibulae.

Upper jaw not sexually dimorphic, extending 0.4 to 0.6 eye diameters behind posterior margin of orbit; maxilla widest at end and truncate, without flexible lamina posteriorly (Fig. 2A); supramaxilla present, small and terminally positioned. Jaws subequal. Premaxilla with an outer row of moderate conical teeth that become progressively smaller and more closely spaced posteriorly and extend ⅔ length of jaw; 1 or 2 rows of smaller inner teeth anteriorly, and usually 2–3 inner teeth on each side of premaxillary symphysis that are somewhat enlarged and canted backwards. Dentary with outer row of conical teeth (slightly smaller than outer symphyseal premaxillary teeth) that are usually slightly larger midlaterally, and 3 or 4 inner rows of teeth (about same size as anterior, outer row teeth) anteriorly, those in innermost row canted backwards. Vomerine teeth 1–3. Infraorbital bones tubular with wide openings for sensory canals (Fig. 3A); 3rd infraorbital relatively robust with a slight suborbital shelf. Second pharyngobranchial very slender and Y-shaped (Fig. 4A).

Measurements of the 73.7 mm holotype (in parentheses) and 12 paratypes, 54.3–72.4 mm, as percentage of SL: predorsal length (31.2) 28.1–31.8; preanal length (53.4) 53.8–59.0; dorsal-fin base (71.2) 69.4–73.9; anal-fin base (40.2) 37.6–43.0; pelvic-fin length (18.0) 17.0–20.4; caudal-fin length (19.5) 17.9–20.8; depth at anal-fin origin (14.2) 12.0–15.6; head length (31.3) 28.7–33.0; orbit diameter (9.2) 8.3–10.4; upper jaw length (15.0) 14.2–16.3. As percentage of head length: postorbital head length (64.9) 63.4–68.4; upper jaw length (47.9) 46.8–52.0; postorbital jaw length (16.3) 13.5–17.4; orbit diameter (29.3) 29.0–32.8.

Preserved coloration. Head and body with scattered pale spots and mottled with various shades of brown; sides with dark midlateral stripe about width of eye and bordered above and below by a row of pale spots, some poorly defined, that contact margins of stripe giving it a scalloped outline; dorsum of some specimens with about 8–10 evenly spaced tan blotches superimposed with small dark spots that extend slightly below lateral line along dorsal-fin base and alternate with upper row of pale spots; pectoral-fin base with large white spot (not shown in illustrated specimen); posterodorsal margin of opercular flap with dark margin; in large specimens, dusky spots usually ring orbital rim, at least dorsally; upper lip with 1 or 2 dusky bands below or slightly behind posterior margin of eye; inner lining of maxilla and mouth pale or light brown but without a distinct blotch or stripe; spinous dorsal fin with a broad submarginal brown stripe and spine tips with noticeably pale fleshy tabs; soft dorsal fin with a narrow dark stripe near base of fin that is bordered above by several rows of small dark spots or blotches; anal fin mostly pale, usually with very narrow brown stripe on proximal third of fin; caudal fin with a pair of pale, oblong, basicaudal spots widely separated by a brown blotch that is a continuation of the midlateral stripe; otherwise caudal fin mostly pale with very faint dusky bands or spots that are best developed on dorsal half of fin; pelvic and pectoral fins immaculate. Some of the non-Houtman Abrolhos Archipelago paratypes (which appear to have better preserved colour patterns) have

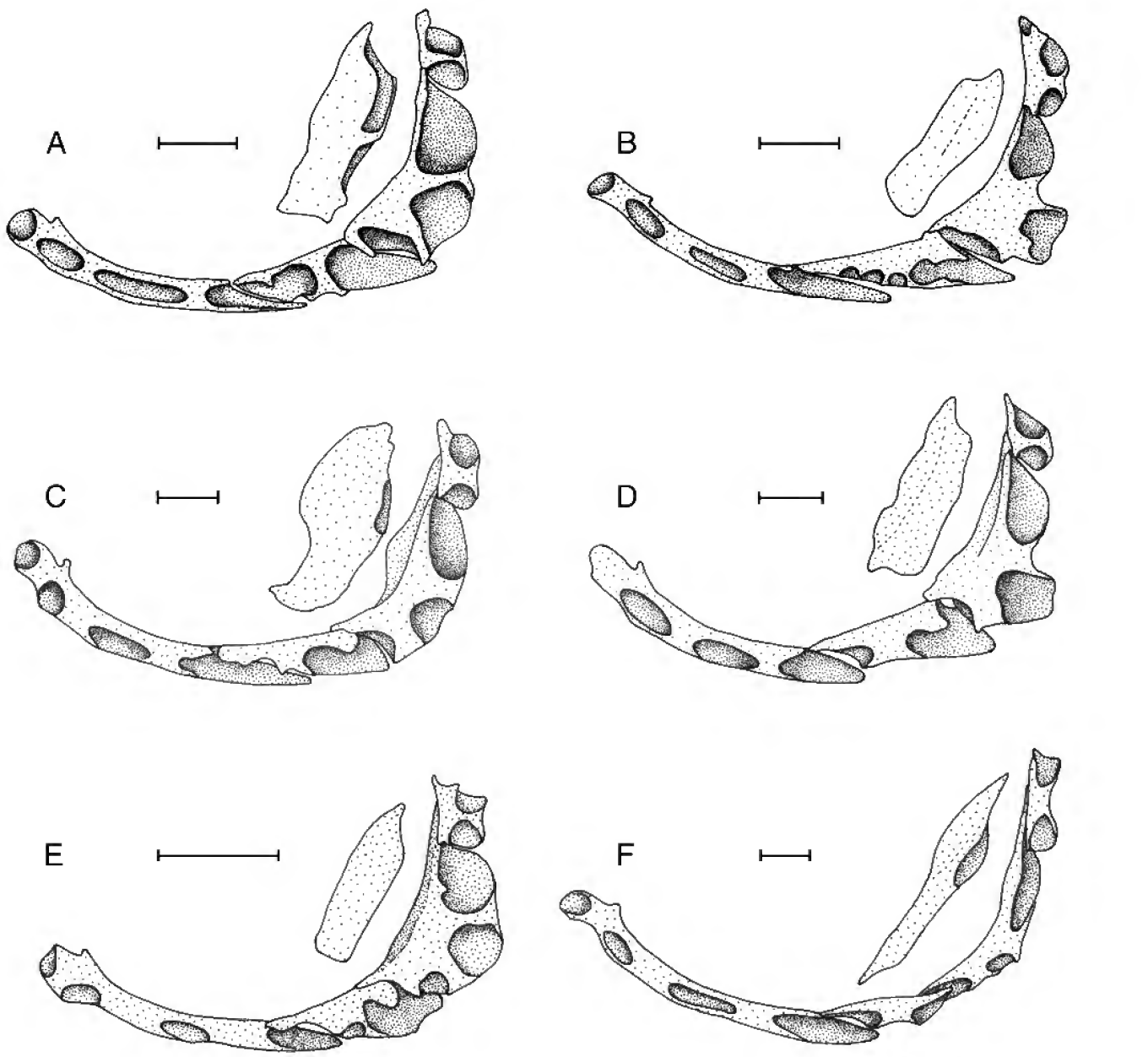

Fig. 3. Lateral views of left infraorbital bones (3rd infraorbital also in rotated dorsal view), excluding dermosphenotic: A, *Opistognathus alleni*, ANSP 157594, 54.3 mm SL; B, *O. seminudus*, ANSP 142950, 55.0 mm SL; C, *O. stigmosus*, WAM P.29641-001, 62.5 mm SL; D, *O. elizabethensis*, AMS I.27891-048, 66.6 mm SL; E, *O. verecundus*, ANSP 167416, 36.9 mm SL; F, *O. reticeps*, NTM S.10718-032, 63.7 mm SL. Scale bars represent 1 mm.

a conspicuous white cheek spot, positioned slightly below the mid-point of postorbital margin of eye that is bordered above by a small dark spot, and 1 or 2 white spots on the opercule.

Live coloration (based on photograph, taken by R.D. Mooi, of freshly collected 53.7 mm SL specimen from Burnside Is.): dark chocolate brown stripe in dorsal and anal fins and midlaterally on sides; background coloration of head and body light yellowish brown; pale spots on cheek, opercle, pectoral-fin base and most of those below midlateral stripe on sides white, other pale spots light yellowish brown; iris pale yellow with a few narrow dark bands radiating from pupil. This individual also has small prominent white spots on the belly that are either absent or less defined in the other specimens.

Etymology. Named in honour of Dr Gerald R. Allen, who recognized the undescribed status of this species, generously made his material available for this study, and whose publications have contributed significantly to knowledge of Indo-Pacific fishes.

Distribution. Known only from Western Australia in depths of 0.2–33 m.

Remarks. In *O. alleni* the second pharyngobranchial is very slender and essentially Y-shaped (Fig. 4A), in most other species of *Opistognathus* this edentate bone is rod-like with the distal end slightly to moderately expanded (character not examined in *O. stigmosus* and *O. elizabethensis*), and in *O. seminudus* the end is greatly expanded (Fig. 4B).

Opistognathus seminudus n.sp.

Figs. 2B, 3B, 4B, 5, 6; Tables 1–4

Opistognathus sp.—Russell, 1983:107 (listed; Heron and One Tree islands).

Type material. HOLOTYPE: AMS I.22794-001, female (59.7), Australia, Great Barrier Reef, Capricorn Group, One Tree Island, reef flat at SW end of island, 0–1 m, V.G. Springer, 30 Nov. 1966, Sta. 66–13. PARATYPES: 78 specimens, 17.7–86.2 mm, all from the Great Barrier Reef. Capricorn Group, One Tree Island: ANSP 142950 (8, 21.5–73.7, 3 C&S) and USNM 220928 (14, 59.5–3.7), same data as holotype; AMS I.15641-042 (73.2), AMS I.15681-063 (4, 60.7–76.1), AMS I.17445-031 (9, 73.0–47.3), 3 m, F. Talbot, 19 Sep. 1968; AMS I.20201-028 (60.0), 0–2 m, D. Hoese, 29 Sep. 1971; AMS I.20212-004 (2, 50.9–85.5), 20 m, F. Talbot *et al.*, 6 Oct. 1971; BPBM 14385 (3, 33.0–70.5), 0.5–1.5 m, J.E. Randall, Jan. 1973; CAS 13790 (1, 72.4), 0.5 m, B.B. Collette and W.N. Eschmeyer, 22 Nov. 1969; CAS 13818 (3, 17.7–63.9), 6 m, F. Talbot *et al.*, 26 Nov. 1969; USNM 220941 (26.6), 8–12 m, V.G. Springer, 7 Dec. 1966; USNM 220942 (67.8), 4 m, V.G. Springer, 1 Dec. 1966; USNM 220943 (9, 23.3–74.6), 5 m, V.G. Springer, 25 Nov. 1966; USNM 220944 (6, 61.0–77.4), 1 m, V.G. Springer, 27 Nov. 1966; and USNM 295803 (3, 80.3–86.2), 4.5 m, V.G. Springer, 11 Dec 1966. Capricorn Group, Wistari Reef: BPBM 14535 (54.0), 22 m, J.E. Randall, 22 Jan. 1973. Capricorn Group, Heron Island: AMS IB.4054–5 (2, 59.8–64.9), AMS I.15482-002 (48.6), H. Choat, 16 Jun. 1965; and USNM 295804 (64.9), H. Choat, 23 Feb. 1967. Gillett Cay: AMS IB.6126 (76.0), AMS IB.6127 (71.9), and AMS IB.6128 (3, 49.8–54.7), Swains Reef Expedition, Oct. 1962. Lizard Island: AMS I.20766-010 (2, 54.5–57.7), D. Hoese *et al.*, 6 Feb. 1975.

Diagnosis. A species of *Opistognathus* with dorsal fin XI (exceptionally X), 14–16; body with about 28–36 oblique scale rows in longitudinal series, and with scales absent anterolaterally forward of verticals from ultimate spine to 2nd segmented dorsal-fin ray; dorsal fin with conspicuous ocellus between spines 2–5; vomerine teeth 1–3.

Description. Dorsal-fin rays XI (exceptionally X), 14–16. Anal-fin rays II, 14–15. Pectoral-fin rays 19–21. Caudal fin: procurrent rays 4–6+4–5, segmented rays 8+8, middle 12–14 branched, total elements 24–27; hypural 5 present. Vertebrae: 10+18 (10+19 in one of 68 specimens); last pleural rib on vertebra 10; epineural ribs 12–15. Supraneurals absent, insertion pattern 0/0/1/1+1/1/. Gill rakers 8–10+16–18 = 24–27.

Scales absent on body anterolaterally forward of verticals from ultimate spine to 2nd segmented dorsal-fin ray, and from head, above lateral line, pectoral-fin base, breast and belly. Body with about 28–36 oblique scale rows in longitudinal series. Lateral-line terminus below verticals from 7th to 11th segmented dorsal-fin rays (total element position 18–22). Lateral line pores numerous, arranged in multiple series along embedded lateral-line tubes. Cephalic sensory pores very numerous (Fig. 6), in adults completely covering most of head, including all of predorsal area except a small area immediately adjacent to dorsal-fin origin; mandibular pore positions 1–3 occupied by relatively large, single pores, 4th position with 4–10 pores, 5th position with 12–24.

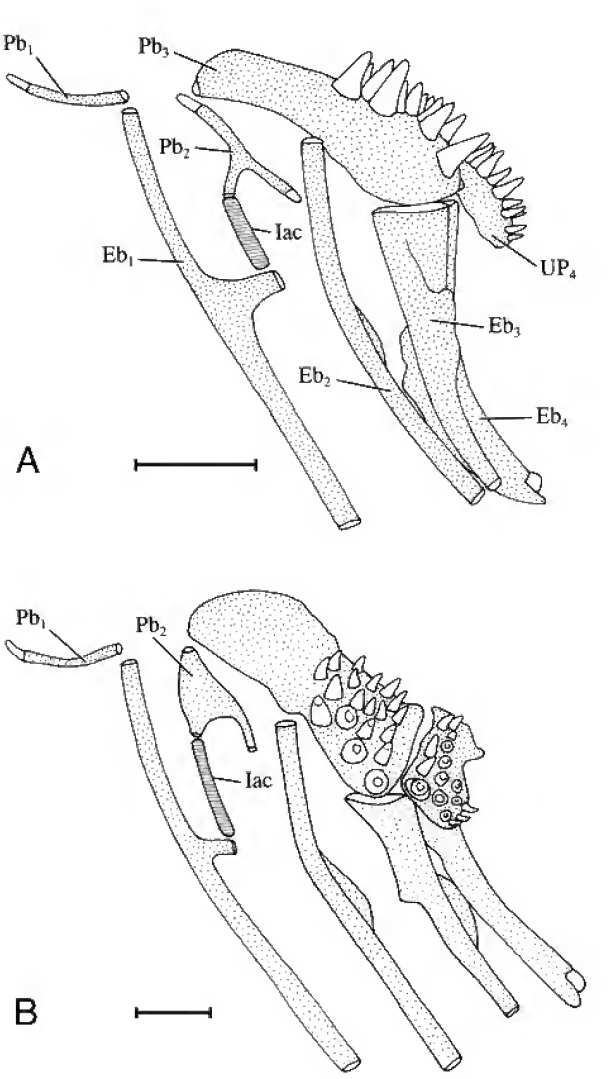

Fig. 4. Dorsal gill arches (right side, ventral views): A, *Opistognathus alleni*, ANSP 157594, 54.3 mm SL; B, *O. seminudus*, ANSP 142950, 55.0 mm SL. Eb = epibranchial, Pb = pharyngobranchial, Iac = interarcual cartilage, UP upper pharyngeal toothplate; scale bars represent 1 mm.

Anterior nostril distinctly closer to posterior nostril than to dorsal margin of upper lip, and with a simple, flattened tentacle on posterior rim that when depressed usually reaches margin of orbit; height of tentacle about 1.5 to 2.0 times maximum diameter of posterior nostril. Dorsal fin very low anteriorly, gradually increasing in height posteriorly; profile relatively uniform with only a slight change in fin height at junction of last spine and anterior segmented rays. Dorsal-fin spines relatively short and straight, at most only slightly curved distally and without flexible tips; tips of spines with slightly swollen fleshy tabs; all segmented dorsal- and anal-fin rays branched distally or 1st anal ray unbranched. Outermost segmented pelvic-fin ray not tightly bound to adjacent ray, interradial membrane incised distally. Upper margin of opercle straight and slightly rounded posterodorsally; posterior margin of preopercle indistinct without a free margin. No papillae on inner surface of lips. Fifth cranial nerve passes under A1β section of adductor mandibulae.

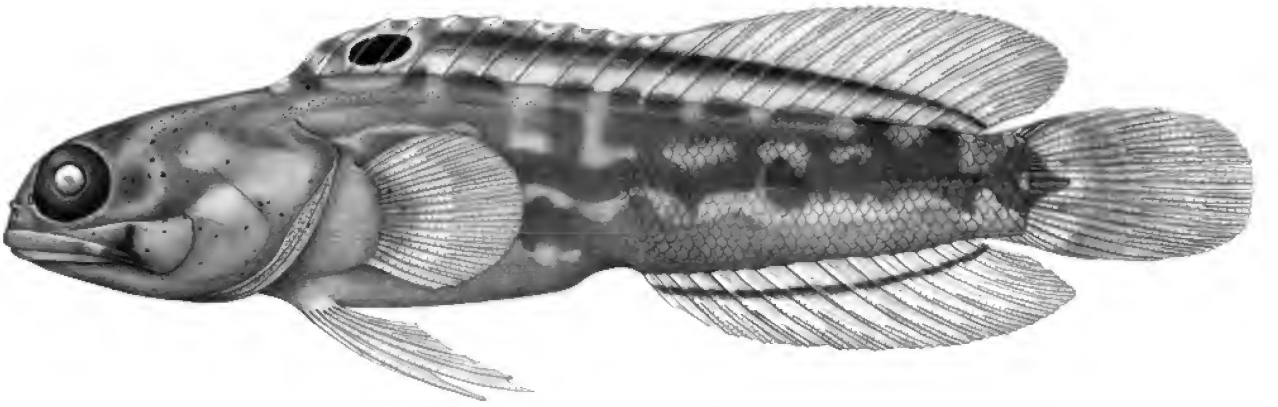

Fig. 5. *Opistognathus seminudus*, paratype, AMS I.15681-063, male, 76.1 mm SL, One Tree Island, Great Barrier Reef. Drawn by Jack R. Schroeder.

Upper jaw slightly sexually dimorphic, extending 0.8 to 1.1 (♂♂) and 0.6–0.9 (♀♀) eye diameters behind posterior margin of orbit; maxilla widest at end and rounded, without flexible lamina posteriorly (Fig. 2B); supramaxilla present, small and terminally positioned. Jaws subequal. Premaxilla with an outer row of stout conical teeth that become progressively smaller posteriorly; 1 or 2 inner rows of smaller conical teeth anteriorly, those nearest symphysis largest and usually canted backward. Dentary with an outer row of moderate teeth, largest midlaterally, extending ½ to ⅔ length of jaw, and an inner row of smaller conical teeth anteriorly that are usually strongly hooked backward. Vomerine teeth 1–3. Infraorbital bones tubular, with wide openings for sensory canals (Fig. 3B); 3rd infraorbital relatively robust and "L" shaped with a slight suborbital shelf. Second pharyngobranchial rod-shaped with distal end greatly expanded (Fig. 4B).

Measurements of the 59.7 mm female holotype (in parentheses) and 23 paratypes, 13 ♂♂ 57.9–86.2 mm and 10 ♀♀ 60.6–73.7 mm, as percentage of SL: predorsal length (30.9) 29.9–35.0; preanal length (58.6) 58.8–64.7; dorsal-fin base (67.0) 62.9–70.1; anal-fin base (31.6) 29.4–35.4; pelvic-fin length (24.6) 17.3–25.2; caudal-fin length (22.3) 21.4–24.8; depth at anal-fin origin (16.9) 14.9–19.1; head length (34.0) 33.0–36.2; orbit diameter (11.5) 9.9–11.5; upper jaw length (19.4) 19.9–22.3 ♂♂, 18.8–22.1. As percentage of head length: postorbital head length (63.6) 62.6–69.0; upper jaw length (57.1) 56.8–64.0 ♂♂, 55.1–64.2 ♀♀; postorbital jaw length (24.4) 23.4–32.5 ♂♂, 19.5–25.7 ♀♀; orbit diameter (34.0) 27.5–33.6.

Preserved coloration. Head and body various shades of brown; several irregular, wavy rows of pale marking or oblong spots on body and a wedge-shaped basicaudal blotch extending onto middle caudal-fin rays; larger specimens with many tiny black spots scattered on head and jaws; branchiostegal membranes and inner lining of maxilla and adjacent membranes dark brown, and a dark diagonal blotch externally on upper jaw positioned at rictus of mouth; dorsal fin mostly pale except conspicuous ocellus between spines 2–5 and a narrow dark stripe immediately behind ocellus (only a continuous dark stripe in small juveniles) extending length of fin diagonally to just above base of last ray; dorsal-fin spines with distinctly pale slightly fleshy tabs; anal fin pale with a narrow, suprabasal, dark stripe; pelvic, pectoral, and caudal fins immaculate.

Live coloration (based on aquarium photograph taken by P.C. Heemstra, of a 79.4 mm SL specimen from Heron Is.): pale background coloration of head and body mostly white, as are pale areas in fins; spot in ocellus black and other dark areas various shades of brown.

Etymology. The specific epithet, from the Latin *semi* (half) and *nudus* (bare, naked), refers to the naked anterior half of the body.

Distribution. Endemic to the Great Barrier Reef where collected in 0.5–22 m.

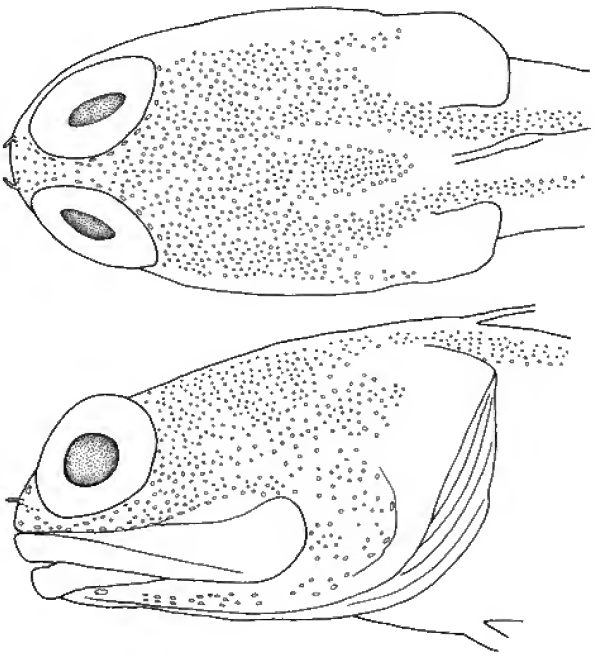

Fig. 6. Cephalic sensory pores of *Opistognathus seminudus*, AMS I.17445-031, male, 64.0 mm SL, One Tree Island, Great Barrier Reef.

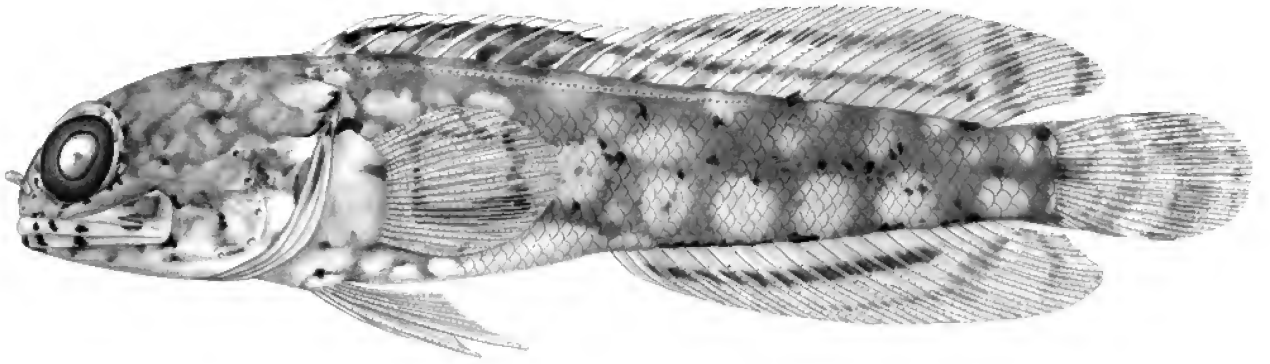

Fig. 7. *Opistognathus stigmosus*, holotype, AMS I.22583-004, male, 70.6 mm SL, Escape Reef, Queensland, Australia. Drawn by Jack R. Schroeder.

Opistognathus stigmosus n.sp.

Figs. 3C, 7; Tables 1–4

Opistognathus sp.—Randall *et al.*, 1990: 356, unnumbered colour fig. (brief diagnosis; common name "coral sea jawfish").

Type material. HOLOTYPE: AMS I.22583-004, male (70.5), Australia, Queensland, Escape Reef, 15°49'S 145°50'E, outer reef, 29 m, G.R. Allen, T. Ayling and W. Starck, 29 Oct. 1981, sta. ER 81–11. PARATYPES: 3 specimens, 42.9–62.5 mm, all from the Great Barrier Reef. AMS I.22583-037, sex undetermined (42.9), same data as holotype; WAM P.27467-004, gravid female (58.5), Escape Reef, G.R. Allen *et al.*, 30 Oct 1981; WAM P.29641-001, male (62.5), Lihou Reef, Juliette Cay, 17°21'S 151°33'E, 20–23 m, G.R. Allen, 14 Nov. 1987.

Diagnosis. A species of *Opistognathus* with dorsal fin X, 19; body with about 38–45 oblique scale rows in longitudinal series, and with scales absent anterolaterally forward of verticals from 5th to 7th dorsal-fin spines; lower half of sides with longitudinal row of 7 or 8 large white spots, the largest with a dark brown border and covered by appressed pectoral fin; vomerine teeth absent.

Description. Dorsal-fin rays X, 19. Anal-fin rays II, 18. Pectoral-fin rays 19–21. Caudal fin: procurrent rays 5+4–5, segmented rays 8+8, middle 14 branched, total elements 25–26; hypural 5 absent. Vertebrae: 10+23; last pleural rib on vertebra 10; epineural ribs 13–14. Supraneurals absent, insertion pattern 0/0/1/1+1/1/. Gill rakers 7–9+15–18 = 22–27.

Scales absent on body anterolaterally forward of verticals from 5th to 7th dorsal-fin spines, and from head, nape, above lateral line, pectoral-fin base, breast and anterior ⅓ of belly. Body with about 38–45 oblique scale rows in longitudinal series. Lateral-line terminus below verticals from 7th or 8th segmented dorsal-fin rays (total element position 17 or 18). Lateral line pores numerous, arranged in multiple series above and below embedded lateral-line tubes. Cephalic sensory pores very numerous, in adults completely covering most of head, including all of predorsal area except a small area immediately adjacent to dorsal-fin origin; mandibular pore positions 1–3 occupied by relatively large, single pores, 4th position with 2–5 pores, 5th position with 6–12.

Anterior nostril distinctly closer to posterior nostril than to dorsal margin of upper lip, and with a simple, relatively long tentacle on posterior rim that when depressed usually barely reaches to or almost to margin of orbit; height of tentacle about 1.5 times maximum diameter of posterior nostril. Dorsal fin low anteriorly gradually increasing in height posteriorly; profile relatively uniform with only a slight change in fin height at junction of spinous and segmented rays. Dorsal-fin spines relatively short and straight, at most only slightly curved distally and without flexible tips; skin covering tips of spines with slightly swollen fleshy tabs; all segmented dorsal- and anal-fin rays branched distally. Outermost segmented pelvic-fin ray not tightly bound to adjacent ray, interradial membrane incised distally. Upper margin of opercle straight and slightly rounded posterodorsally; posterior margin of preopercle indistinct without a free margin. No papillae on inner surface of lips. Fifth cranial nerve passes under A1β branch of adductor mandibulae.

Upper jaw not sexually dimorphic, extending 0.4 to 0.5 eye diameters behind posterior margin of orbit; maxilla widest at end and truncate, without flexible lamina posteriorly; supramaxilla present, small and terminally positioned. Jaws subequal. Premaxilla with moderate conical teeth in outer row that become progressively smaller and more closely spaced posteriorly; 1–3 irregular rows of smaller, sharply pointed, inner teeth anteriorly, those in innermost row slightly larger and canted backwards. Dentary with outer row of conical teeth, all about the same size and about ½ size of largest premaxillary teeth; 1–4 irregular, inner rows of slightly smaller conical teeth anteriorly, those in innermost row slightly canted backwards. Vomerine teeth absent. Infraorbital bones tubular, with wide openings for sensory canals (Fig. 3C), third infraorbital relatively robust with a slight suborbital shelf.

Measurements of the 70.5 mm holotype (in parentheses) and 3 paratypes, 42.9–62.5 mm, as percentage of SL: predorsal length (35.2) 32.8–35.0; preanal length (54.9) 55.6–58.6; dorsal-fin base (69.1) 67.4–71.8; anal-fin base (34.5) 36.3–36.7; pelvic-fin length (23.0) 23.0–23.6; caudal-fin length (19.4) 19.4–22.3; depth at anal-fin origin (15.6) 13.9–16.3; head length (34.5) 33.5–35.0; orbit diameter (11.5) 11.5–12.1; upper jaw length (19.3) 17.3–19.0. As percentage of head length: postorbital head length (61.2) 59.3–61.7; upper jaw length (55.9) 51.5–54.3; postorbital jaw length (15.2) 12.8–14.0; orbit diameter (33.3) 34.2–34.7.

Table 2. Frequency distributions of gill-raker counts in selected Australia species of *Opistognathus* (values for holotypes in boldface).

species	upper gill-rakers 7	8	9	10	mean	lower gill-rakers 15	16	17	18	19	mean	total gill-rakers 22	23	24	25	26	27	28	29	mean
alleni		**13**	26	1	8.7		11	**27**	2		16.8			6	**12**	20	1	1		25.5
seminudus		**32**	30	1	8.5		14	**41**	8		16.9			8	**28**	19	8			25.4
stigmosus	**1**	2	1		8.0	**1**	1	1	1		16.5	**1**	—	1	1	—	1			24.5
elizabethensis		4			8.0		**1**	3			16.7			**1**	3					24.8
verecundus		11	**13**		8.5	**10**	13	1			15.6		5	**11**	7	1				24.2
reticeps			**6**	1	9.1			1	**5**	1	18.0					1	**5**	—	1	27.2

Preserved coloration. Head and body overall tan, longitudinal row of 7 or 8 large white spots on lower half of sides; the largest with a dark brown border, widest ventrally, and covered by appressed pectoral fin; a second row of smaller indistinct pale spots above primary row; laterally a small dark spot present opposite dorsal ⅓ of otherwise pale pectoral-fin base; this spot on mesial side of pectoral-fin base where it may continue downward as a diagonal mark; small dark blotch also present on body immediately above pectoral-fin base; head and sides punctuated with widely scattered small dark brown spots, including one just behind posterodorsal margin of upper jaw; other dark spots ring orbital rim, those in interorbital region always very dark and symmetrically arranged in bilateral pairs; conspicuous dark spots or bands on upper and lower lips, two largest specimens each with 6 bands on lower lip; inner lining of maxilla and mouth immaculate; spinous dorsal fin with submarginal narrow dark stripe; tips of dorsal-fin spines with noticeably pale fleshy tabs; soft dorsal and anal fins with narrow dark suprabasal stripe bordered above by diffuse submarginal brown stripe, and dark bands or spots; caudal fin with pair of pale basicaudal spots (separated by a narrow inverted wedge-shaped blotch with a pale centre) followed by 1 or 2 dusky bands separated by pale interspaces; pelvic and pectoral fins immaculate.

Live coloration (based on Randall *et al.*, 1990): body and head various shades of brown, pale spots and markings white; iris yellow with a few narrow dark bands radiating from pupil.

Etymology. The specific epithet, from the Latin *stigmosus* (full of marks), refers to the conspicuous, small dark spots on the head of this species.

Distribution. Known only from the Great Barrier Reef (Escape Reef) and the Coral Sea Plateau (Lihou Reef) in 20–29 m.

Opistognathus elizabethensis n.sp.

Figs. 3D, 8; Tables 1–4

"*Opistognathus* n.sp.".—Gill & Reader. 1992:220 (listed in annotated checklist of fishes collected at Middleton and Elizabeth Reefs).

Type material. HOLOTYPE: AMS I.27891-010, male (60.4), Elizabeth Reef, N side near lagoon entrance, 29°56'S 159°01'E, 0–5 m, explosives, D.M. Williams, *et al.*, Dec. 1981. PARATYPES: 3 specimens, 66.6–71.4 mm. AMS I.27891-048, gravid females (2, 66.6–70.8), same data as holotype; AMS I.27152-014, male (71.4), Elizabeth Reef, outer SW reef slope, 29°57'S 159°02'E, 15–18 m, A. Gill and S. Reader, 10 Dec. 1987.

Diagnosis. A species of *Opistognathus* with dorsal fin XI, 18 or 19; body with about 47–51 oblique scale rows in longitudinal series, and scales absent anterolaterally forward of verticals from 6th or 7th dorsal-fin spine; dorsal fin with an oblong black spot (partially encircled by white border) between spines 3–6 that extends slightly onto dorsum; vomerine teeth 2 or 3.

Description. Dorsal-fin rays XI, 18–19. Anal-fin rays II, 17–19. Pectoral-fin rays 19–21. Caudal fin: procurrent rays 5–6+4–5, segmented rays 8+8, middle 13 or 14 branched, total elements 25 or 27; hypural 5 absent. Vertebrae: 10+23; last pleural rib on vertebra 10; epineural ribs 13–14. Supraneurals absent, insertion pattern 0/0/1/1+1/1/. Gill rakers 8+16–17 = 24–25.

Scales absent on body anterolaterally forward of verticals from 6th or 7th dorsal-fin spines, and from head, nape, above and slightly below lateral line, pectoral-fin base, breast and anterior ⅓ of belly. Body with about 47–51 oblique scale rows in longitudinal series. Lateral-line terminus below verticals from 4th to 7th segmented dorsal-fin ray (total

Table 3. Frequency distributions of oblique scale rows in longitudinal series in selected Australian species of *Opistognathus* (values for holotypes in boldface). Asterisk following species name indicates that bilateral counts were made.

species	oblique scale rows 21 22	23 24	25 26	27 28	29 30	31 32	33 34	35 36	37 38	39 40	41 42	43 44	45 46	47 48	49 50	51 52	53 54	55 56	57 58	59 60	61 62	63 64	n	mean	SD
alleni	1	4	**14**	10	8	1																	38	26.7	2.1
seminudus				1	18	**22**	8	1															50	31.2	1.2
*stigmosus**									1	**4**	1	—	2										8	40.8	2.8
*elizabethensis**														**4**	2	1							7	48.6	1.3
verecundus												2	—	2	**4**	3	1						12	49.4	3.1
*reticeps**																		1	**6**	2	—	1	10	58.5	2.3

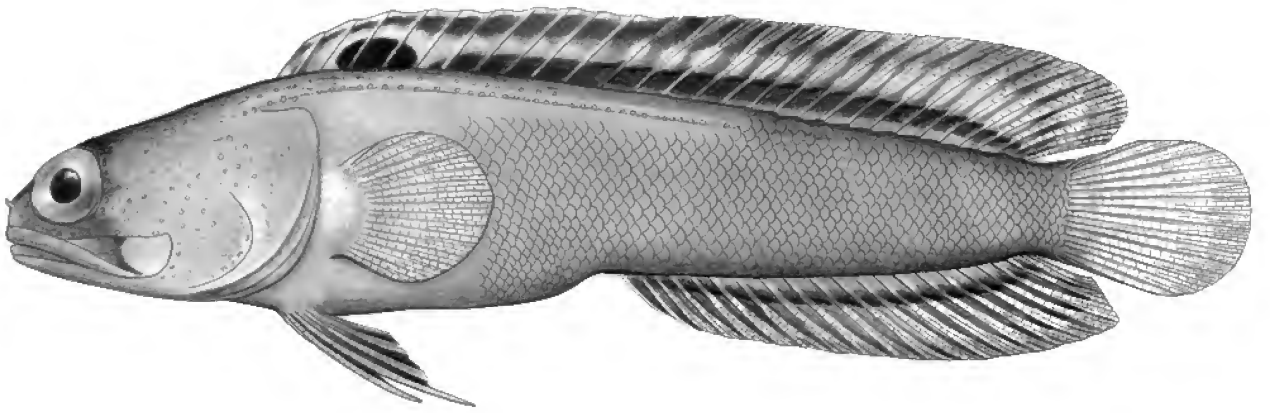

Fig. 8. *Opistognathus elizabethensis*, holotype, AMS I.27891-010, male, 60.4 mm SL, Elizabeth Reef. Drawn by Tracy D. Pedersen.

element position 15–18). Lateral line pores moderate, arranged in single series above and below embedded lateral-line tubes. Cephalic sensory pores numerous, completely covering most of head, including all of predorsal area except a small area immediately adjacent to dorsal-fin origin; mandibular pore positions 1–3 occupied by relatively large, single pores, 4th position occupied by 1–3 pores, 5th position with 7–11 pores.

Anterior nostril about midway between posterior nostril and dorsal margin of upper lip, consisting of a raised tube with a short tentacle on posterior rim that when depressed does not reach or barely reaches margin of posterior nostril; height of tentacle about 0.5 to 1.0 times maximum diameter of posterior nostril. Dorsal fin moderately low anteriorly, gradually increasing in height posteriorly; profile relatively uniform with only a slight change in fin height at junction of spinous and segmented rays. Dorsal-fin spines moderately short and straight, not curved distally and without flexible tips; skin covering tips of spines with slightly swollen fleshy tabs; all segmented dorsal- and anal-fin rays branched distally. Outermost segmented pelvic-fin ray not tightly bound to adjacent ray, interradial membrane incised distally. Upper margin of opercle straight and slightly rounded posterodorsally; posterior margin of preopercle indistinct without a free margin. No papillae on inner surface of lips. Fifth cranial nerve passes under A1β section of adductor mandibulae.

Upper jaw not sexually dimorphic, extending 0.6 to 0.9 eye diameters behind posterior margin of orbit; maxilla widest at end and truncate, without flexible lamina posteriorly; supramaxilla small and terminally positioned. Jaws subequal, lower slightly included. Premaxilla with moderate conical teeth in outer row that become progressively smaller and more closely spaced posteriorly; 1 or 2 rows of much smaller inner teeth anteriorly, and 2 or 3 inner teeth on each side of premaxillary symphysis that are as large or larger than outer teeth and hooked backwards. Dentary with outer row of conical teeth (slightly smaller than outer, anterior premaxillary teeth) that are largest midlaterally; 2 inner rows of teeth (about same size as anterior outer row teeth) anteriorly, with most teeth in innermost row slightly canted backwards. Vomerine teeth 2 or 3. Infraorbital bones tubular, with wide openings for sensory canals (Fig. 3D); 3rd infraorbital relatively robust and "L" shaped with a slight suborbital shelf.

Measurements of the 60.4 mm holotype (in parentheses) and 3 paratypes, 66.6–71.4 mm, as percentage of SL: predorsal length (29.5) 28.8–30.9; preanal length (58.6) 55.6–60.6; dorsal-fin base (68.5) 70.6–71.1; anal-fin base (37.7) 32.6–34.7; pelvic fin-length (20.0) 21.5–22.4; caudal-fin length (19.7) 19.4–19.6; depth at anal-fin origin (15.6) 16.3–16.8; head length (31.6) 31.2–32.9; orbit diameter (8.5) 8.5–9.5; upper jaw length (18.4) 17.2–18.0. As percentage of head length: postorbital head length (64.7) 63.0–66.4; upper jaw length (58.1) 52.3–57.6; postorbital jaw length (20.2) 16.2–25.3; orbit diameter (27.0) 27.3–28.8.

Preserved coloration. Head and body uniformly tan; inner lining of maxilla and adjacent membranes dark brown, and a dark diagonal blotch externally on upper jaw positioned at rictus of mouth; dorsal fin with an oblong black spot between spines 3–6, encircled by narrow white border and

Table 4. Frequency distributions of lateral-line terminus in relation to total dorsal-fin element position in selected Australian species of Opistognathus (holotype values in boldface). When terminus ended mid-way between two elements, the higher number was used.

	lateral-line terminus position																				
species	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	n	mean	SD
alleni														4	9	**12**	5	5	35	24.9	1.2
seminudus									6	15	**31**	7	2						61	19.7	0.9
stigmosus								1	**3**										4	17.8	0.5
elizabethensis						1	—	**2**	1										4	16.8	1.3
verecundus				10	13	**2**													27	13.7	0.6
reticeps	1	—	**1**	2	1	2													7	13.1	1.8

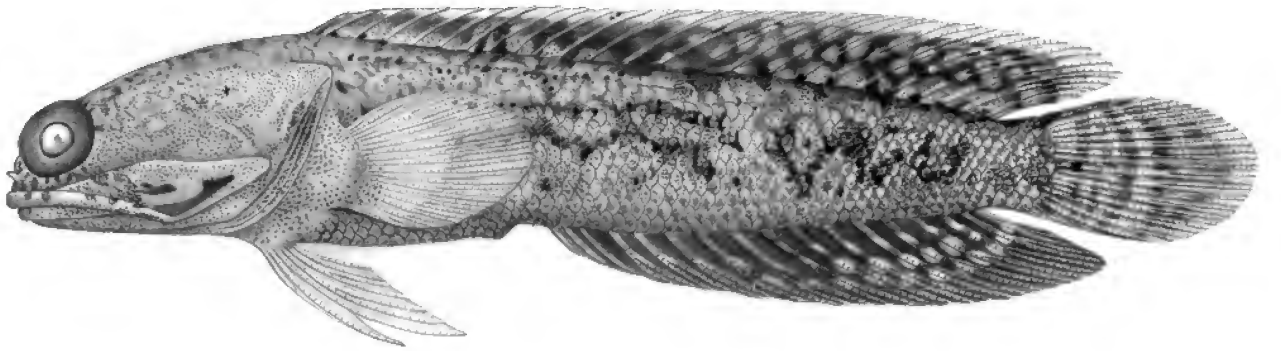

Fig. 9. *Opistognathus verecundus*, holotype, NTM S.10016-003, male, 52.6 mm SL, Cobourg Peninsula, Northern Territory, Australia. Drawn by Jack R. Schroeder.

extending slightly onto dorsum; remainder of fin with a very narrow pale basal stripe extending length of fin and bordered, in succession, by a narrow dark stripe, another pale stripe (in the largest paratype consisting of a row of narrowly connected white spots, each of which is centred on a fin ray), bordered above by dark pigment; tips of dorsal-fin spines with swollen fleshy pads that are mostly dark (these structures pale or white in *O. alleni* and *O. seminudus*); anal fin with a narrow pale basal stripe bordered by a narrower dark stripe, remainder of fin mostly uniform brown; pectoral fins immaculate; caudal fin pale dusky, and pelvic fins dark brownish, darkest on interradial membranes. In the largest paratype the pelvic and anal fins are almost uniformly black, and the belly noticeably dark. This specimens also differs from the others in having a small pair of widely separated, pale, basicaudal spots; these spots perhaps more noticeable owing to the darker caudal fin of this specimen.

Live coloration (A.C. Gill, pers. comm.): body yellowish-brown and pale markings in dorsal fin blue.

Etymology. The specific epithet refers to the type locality. If not an Elizabeth Reef endemic, this species likely occurs only at Elizabeth and the adjacent Middleton Reef (see below).

Distribution. Known only from Elizabeth Reef, where collected between 0–18 m, but possibly also present at the adjacent Middleton Reef (29°30'S 159°12'E). These two coral capped, volcanic seamounts, located about 500 km off Coffs Harbour, NSW, Australia, represent the southern-most coral atolls in the world (Slater & Phipps, 1977). Francis (1993) noted that the relatively young Lord Howe Island (6.9–6.4 million years B.P.) and Elizabeth and Middleton Reefs share a large number of species and probably should be treated as a single biogeographic unit. Lord Howe Island (31°33'S 159°4'E), Elizabeth and Middleton Reefs are only three of more than 20 known volcanic peaks in the Tasman Sea (Slater & Goodwin, 1973) that form parallel north-south chains along the western margin of the Lord Howe Rise and the trough between Lord Howe Rise and Australia. Although these three peaks are the only ones presently at or above sea level, their faunas may have been derived from older, now submerged, structures.

Opistognathus verecundus n.sp.

Figs. 2C, 3E, 9, 10; Tables 1–4

Opistognathus sp.—Larson & Williams, 1997: 366 (listed; Darwin Harbour).

Type material. HOLOTYPE: NTM S.10016-003, male (52.6), Australia, Northern Territory, Cobourg Peninsula, E. side Coral Bay, 11°11'S 132°04'E, 5–6 m, Helen K. Larson and P. Homes, 18 Oct. 1981. PARATYPES: 28 specimens, 14.2–48.1 mm, all taken with the holotype. AMS I.33644-001 (4, 35.2–39.4), ANSP 167416 (4, 29.5–48.1, 1 C&S), NTM S.10016-046 (12, 14.2–47.2), USNM 320261 (4, 25.1–44.8), WAM P.30593-001 (4, 33.5–37.3).

Diagnosis. A species of *Opistognathus* with dorsal fin X–XI, 14 or 15 (typically XI, 14); upper jaw sexually dimorphic with flexible lamina posteriorly, end of maxilla slightly rounded (females) becoming increasingly elongate and scimitar-shaped (adult males); oblique scale rows 39–54 in longitudinal series; total gill-rakers on first arch 23–26; spinous dorsal fin with a single brownish spot, if present, between spines 2–4.

Description. Dorsal-fin rays X–XI, 14 or 15 (typically XI, 14). Anal-fin rays III, 14 (rarely 13 or 15). Pectoral-fin rays 18 or 19. Caudal fin: procurrent rays 4–5+3–5, segmented rays 8+8, middle 12–14 branched, total elements 23–26; hypural 5 absent. Vertebrae: 10+18 (19 in one of 29 specimens); last pleural rib on vertebra 10; epineural ribs 11–12. Supraneurals 1 (based on radiographs but in the only C&S specimen a tiny cartilaginous ball is present in the first interneural space), insertion pattern 0/S/1/1+1/1/. Gill rakers 8–9+15–17 = 23–26.

Scales absent on head, nape, above lateral line, pectoral-fin base, breast and anterior ¼ to ½ of belly. Body with about 44–54 oblique scale rows in longitudinal series. Lateral-line terminus below verticals from 2nd to 4th segmented dorsal-fin rays (total element position 13–15). Lateral line pores numerous, arranged in multiple series above and below embedded lateral-line tubes. Cephalic sensory pores numerous, completely covering most of head, including all of predorsal area except a small area immediately adjacent to dorsal-fin origin; mandibular pore positions 1–3 occupied by relatively large, single pores, 4th position with 1–3 (usually 2) pores, 5th with 3–7 pores.

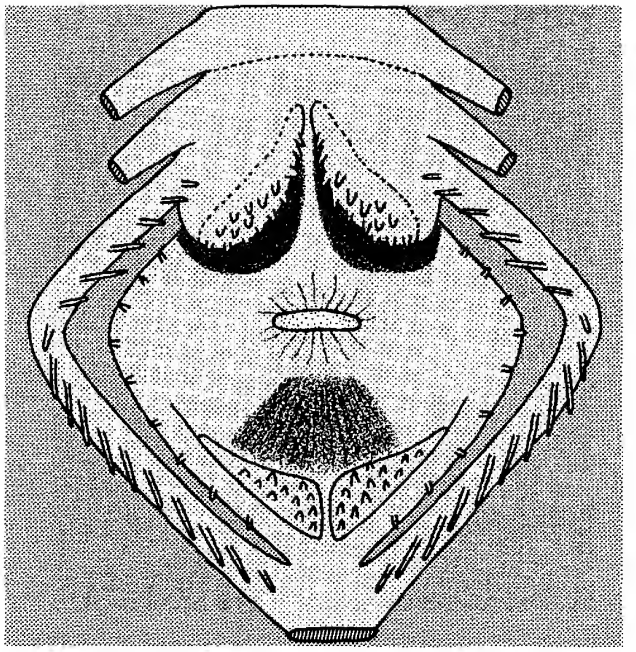

Fig. 10. Semidiagrammatic drawing showing buccal pigmentation in *Opistognathus verecundus*.

Anterior nostril about mid-way between posterior nostril and dorsal margin of upper lip, consisting of a short tube with posterior rim longer, that when depressed does not reach or just reaches margin of posterior nostril; height of tube shorter than to about equal maximum diameter of posterior nostril. Dorsal fin moderately low anteriorly, with profile relatively uniform without change in fin height at junction of last spine and anterior segmented rays. Dorsal-fin spines relatively slender and slightly curved distally, with flexible tips; all segmented dorsal- and anal-fin rays branched distally or 1st anal ray unbranched. Outermost segmented pelvic-fin ray not tightly bound to adjacent ray, interradial membrane incised distally. Upper margin of opercle straight and slightly rounded posterodorsally; posterior margin of preopercle indistinct without a free margin. No papillae on inner surface of lips. Fifth cranial nerve passes under A1β section of adductor mandibulae.

Upper jaw sexually dimorphic (longest in adult males) and extending 1.1 to 2.1 eye diameters behind posterior margin of orbit; maxilla widest before end, with flexible lamina posteriorly (Fig. 2C), scimitar-shaped in adult males; supramaxilla moderately large and subterminally positioned. Jaws subequal, lower slightly included. Premaxilla with an outer row of moderately large, sharply pointed, conical teeth, those near posterior end of jaw noticeably smaller and more closely spaced; 2 or 3 irregular inner rows of much smaller conical teeth present anteriorly, with those adjacent to premaxillary symphysis slightly enlarged. Dentary with an outer row of conical teeth that are blunter anteriorly, those on posterior half of dentary largest and slightly hooked inward; 2 or 3 inner rows of slightly smaller, conical teeth anteriorly, those in innermost row canted backwards. Vomerine teeth absent. Infraorbital bones tubular, with wide openings for sensory canals (Fig. 3E); 3rd infraorbital relatively robust but without a suborbital shelf. Second pharyngobranchial rod-shaped with distal end slightly expanded.

Measurements of the 52.6 mm male holotype (in parentheses) and 15 paratypes, 9 ♂♂ 35.9–48.1 mm and 6 ♀♀ 35.2–47.2 mm, as percentage of SL: predorsal length (31.6) 28.9–32.0; preanal length (55.1) 52.4–56.6; dorsal-fin base (74.3) 65.0–76.1; anal-fin base (38.8) 36.3–40.8; pelvic-fin length (20.0) 20.4–22.8; caudal-fin length (21.5) 19.8–22.8; depth at anal-fin origin (15.0) 12.5–16.2; head length (32.7) 29.8–32.6; orbit diameter (8.3) 8.1–9.3; upper jaw length (25.9) 20.4–24.5 ♂♂, 19.0–21.1 ♀♀. As percentage of head length: postorbital head length (68.9) 65.2–68.4; upper jaw length (79.1) 65.2–78.9 ♂♂, 61.6–66.5 ♀♀; postorbital jaw length (52.3) 33.9–45.3 ♂♂, 29.9–35.6 ♀♀; orbit diameter (25.3) 25.7–29.9.

Preserved coloration. Head and body ground colour light tan, with darker freckling; in larger specimens branchiostegal membranes and pectoral-fin base finely peppered with melanophores; inner lining of maxilla and adjacent membranes with 2 brownish stripes (best developed in adult males) that when mouth is closed are partially visible as lateral streaks on expanded part of the upper jaw; buccal pigmentation (Fig. 10) consisting of diffuse dusky area on floor of mouth in front of esophageal opening and a pair of slightly separated dark blotches on roof of mouth behind upper pharyngeal toothplates; in some specimens, a series of small dark blotches present on sides and about 8 equally spaced blotches on dorsum along dorsal-fin base; in a few specimens first 2 blotches relatively dark and extending onto dorsal fin; dorsal and anal fins dusky with blotches and pale spots that that tend to form rows; in some specimens a pair of pale basicaudal spots evident and caudal fin with several indistinct narrow dusky bands; pelvic and pectoral fins immaculate.

Etymology. The specific epithet is from the Latin *verecundus* (bashful or shy), in allusion to the burrow-dwelling habit.

Distribution. Known only from the type locality off Cobourg Peninsula, northern Australia, where collected in 5–6 m.

Remarks. This species is apparently most closely related to the allopatric *O. solorensis* Bleeker 1853, known from Indonesia, Philippines and Taiwan. Both have essentially identical upper jaw structures, dentition, fin ray and vertebral counts and buccal pigmentation. *Opistognathus verecundus* differs from *O. solorensis* in having fewer gill-rakers, with 15–17 (versus 18–20) on the lower limb and a total of 23–26 (vs. 27–33), only 44–54 oblique scale rows in longitudinal series (vs. typically 58–69), and only brown spots or markings anteriorly on the spinous dorsal fin, (vs. one or two black spots in this position).

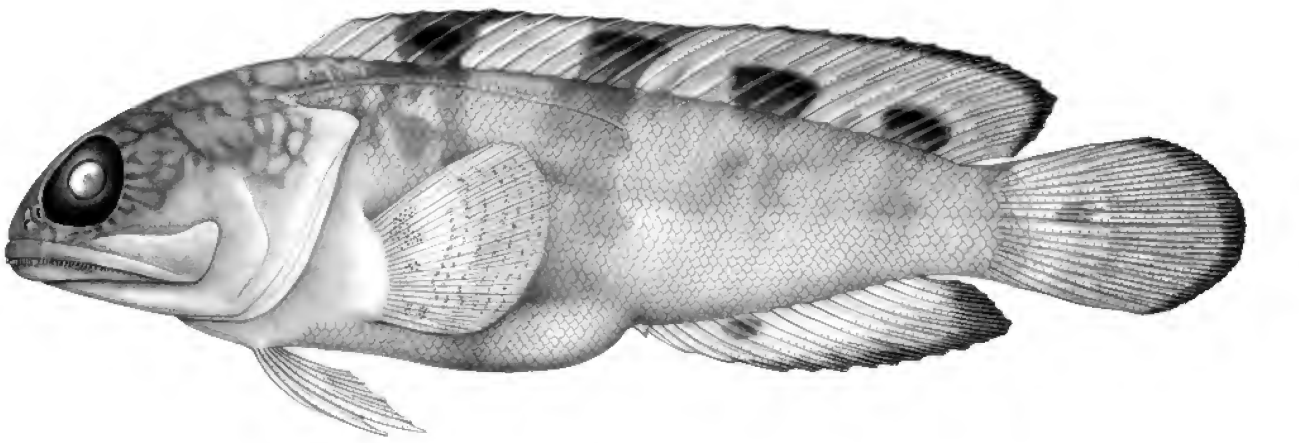

Fig. 11. *Opistognathus reticeps*, paratype, WAM P.24227, female, 113 mm SL, Napier Broome Bay, Western Australia. Drawn by Jack R. Schroeder.

Opistognathus reticeps n.sp.

Figs. 2D, 3F, 11; Tables 1–4

Type material. HOLOTYPE: NTM S.10553-004, gravid female (99.4), Australia, Northern Territory, Darwin Harbour, east arm, 12°29'S 130°53'E, 0–1 m, sta. HL 82–49, H. Larson and R. Williams, 6 Sep. 1982. PARATYPES: 7 specimens, 19.4–117.3 mm. WAM P.24227 (113), Napier Broome Bay, Jul. 1973; NTM S.10158-003 (87.2), Van Diemen Gulf, Northern Territory Fisheries, 17 Jan. 1978, Sta. 11/9; AMS IA.7606, gravid female (117.3), Darwin, near jetty, from burrows on mud flat, M. Ward, 31 Jul. 1938; NTM S.10718-032 (63.7, C&S), Darwin Harbour, east arm, 1.5 m, H. Larson *et al.*, 31 Dec. 1982, Sta. HL 82–91; NTM S.11242-002 (75.4), Darwin Harbour, Wood Inlet, 2 m, H. Larson and R. Williams, 16 Mar. 1984, Sta. HL 84–12; NTM S.10608-013 (19.4), N. Oxley Island, 11°00'S 132°49'E, 11–12 m, H. Larson *et al.*, 21 Oct. 1982, Sta. HL 82–79; NTM S.13282-001 (84.2), Beagle Gulf, N. of Charles Point, 12°15.4'S 130°37.8'E, trawled in 23–29 m, R. Williams, 2 Sep. 1992, Sta. RW 92–2.

Diagnosis. A species of *Opistognathus* with dorsal fin XII, 15 or 16; dorsal fin with 4 dark blotches, the first 2 extending onto distal half of fin; dorsum of head reticulated; lateral-line terminus below verticals from 10th spine to 3rd segmented dorsal-fin ray.

Description. Dorsal-fin rays XII, 15 or 16. Anal-fin rays II, 13 or 14. Pectoral-fin rays 22 or 23. Caudal fin: procurrent rays 3–4+3–4, segmented rays 8+8, middle 12 branched, total elements 22–24; hypural 5 present. Vertebrae: 12+19; last pleural rib on vertebra 12; epineural ribs 15. Supraneurals absent, insertion pattern 0/0/1/1+1/1/. Gill rakers 9–10+17–19 = 26–29.

Scales absent on head, nape, pectoral-fin base (largest specimen with a few embedded scales) and breast; 3 or 4 rows of scales present above lateral line anteriorly and 1 or 2 rows posteriorly. Body with about 56–64 oblique scale rows in longitudinal series. Lateral-line terminus below verticals from 10th spine to 3rd segmented dorsal-fin ray (total element position 10–14). Lateral-line pores relatively sparse, mostly arranged in a single series along embedded lateral-line tubes. Cephalic sensory pores relatively numerous, except pores absent on most of nape; 1st mandibular pore position bipored, all other mandibulo-preopercular pore positions occupied by multiple pores too small and numerous to count accurately; infra- and supraorbital pores also very numerous.

Anterior nostril positioned closer to posterior nostril than to margin of upper lip, and consisting of a short tube with a broad tentacle on posterior rim that when depressed extends to or nearly to posterior margin of posterior nostril; height of tentacle about 1.0–1.5 times maximum diameter of posterior nostril. Dorsal fin moderately low anteriorly, increasing in height posteriorly, with profile relatively uniform without change in height at junction of last spine and anterior segmented rays. Dorsal-fin spines relatively slender and only slightly curved, with flexible tips; skin covering tips of dorsal-fin spines somewhat rugose but without fleshy tabs; all segmented dorsal- and anal-fin rays branched distally, except first 1 or 2 anal rays usually unbranched. Outermost segmented pelvic-fin ray not tightly bound to adjacent ray, interradial membrane incised distally. Upper margin of opercle straight and slightly rounded posterodorsally; posterior margin of preopercle distinct, with a free margin. No papillae on inner surface of lips. Fifth cranial nerve passes over A1β section of adductor mandibulae.

Upper jaw not sexually dimorphic, extending about 0.7–1.0 eye diameters behind posterior margin of orbit; maxilla widest at end and rounded, without flexible lamina posteriorly (Fig. 2D); supramaxilla present, relatively small and terminally positioned. Jaws subequal, lower slightly included. Both jaws with an outer row of enlarged conical teeth that are relatively straight and slant forward, especially anteriorly; 1 or 2 irregular rows of much smaller inner teeth present anteriorly, those adjacent to premaxillary symphysis slightly enlarged and canted posteriorly. Vomerine teeth absent. Infraorbital bones relatively slender and tubular (Fig. 3F); 3rd infraorbital with a slight suborbital shelf. Second pharyngobranchial rod-shaped with distal end slightly expanded.

Measurements of the 99.4 mm holotype (in parentheses) and 5 paratypes, 75–117 mm, as percentage of SL: predorsal length (39.0) 34.6–40.0; preanal length (63.9) 56.9–67.0; dorsal-fin base (62.6) 60.1–69.1; anal-fin base (26.6) 25.4–30.1; pelvic-fin length (22.6) 20.4–25.3; caudal-fin length

(25.8) 24.1–29.8; depth at anal-fin origin (24.1) 22.9–25.5; head length (39.2) 37.1–41.2; orbit diameter (12.5) 12.5–13.9; upper jaw length (25.7) 24.7–26.3. As percentage of head length: postorbital head length (61.8) 57.9–61.6; upper jaw length (65.4) 62.2–67.4; postorbital jaw length (30.1) 23.0–29.8; orbit diameter (31.8) 32.1–35.1.

Preserved coloration. Dorsum of head, snout, upper part of opercle, and nape reticulated with irregular pale markings or spots, remainder of head and body mostly pale to light dusky, except blotches in dorsal fin usually continue across the body as faint bands (best developed in smaller specimens), and a similar basicaudal band may be present on caudal peduncle; dorsal fin with four dark blotches that extend slightly onto dorsum; interradial membranes immediately adjacent to blotches lighter than rest of fin and almost clear in the smaller paratypes; anterior two blotches extending to or almost to distal margin of fin, others becoming progressively smaller in height; 1st blotch positioned between spines 3–6, 2nd between spines 9–12, 3rd between rays 3–6 and 4th between rays 10–14; dorsal and anal fins with narrow dark margins, widest posteriorly; remainder of anal fin pale or with one or two dark spots, slightly smaller than pupil diameter, in basal half of fin aligned with blotches in dorsal fin; caudal fin pale except for narrow dark margin; pelvic fins immaculate and pectoral fins faintly speckled.

Etymology. The specific epithet is from the Latin *rete* (net) and *ceps* (head), in reference to the reticulated dorsum of the head that is a distinguishing feature of this species. The name should be treated as a noun in apposition.

Distribution. Known only from northern Australia.

Remarks. Only *Opistognathus reticeps* and four other species of jawfishes have 12 dorsal-fin spines, and all have different colour patterns (see following identification key). *Opistognathus reticeps* apparently is much smaller (largest individual, a 117 mm SL gravid female) than the other four, all of which attain at least 200 mm. The largest specimens examined (mm SL) of the others are: *O. inornatus* (409); *O. papuensis* (339); *O. reticulatus* (368); *O. latitabundus* (216).

Status of *Tandya* Whitley

Whitley (1930) established the genus *Tandya* (type by original designation, *Opistognathus maculatus* Alleyne & Macleay, 1877 = *O. papuensis* Bleeker, 1868) for Australian jawfishes that have 12 dorsal-fin spines and upper jaws with a truncate maxilla extending posterior to a vertical from the posterior margin of the orbit. He contrasted his new genus only with *Gnathypops* Gill (type species *Opistognathus maxillosus* Poey, 1860), which was erroneously reported to have 8 (actually 11) dorsal-fin spines. Smith-Vaniz (1997) redescribed *O. maxillosus*, recognizing *Gnathypops* as a junior synonym of *Opistognathus* Cuvier. Inexplicably, both Whitley (1930) and McKay (1969) assigned *Opistognathus darwiniensis* Macleay, 1878 to *Tandya* although it has only 11 dorsal-fin spines. Three other jawfishes with 12 dorsal-fin spines that have sometimes been referred to *Tandya* are *Opistognathus inornatus* Ramsay & Ogilby, 1887, *Tandya latitabunda* Whitley, 1937 and *Tandya reticulata* McKay, 1969. *Opistognathus inornatus* differs from the allopatric *O. papuensis* only in colour pattern and its taxonomic rank is subjective.

Species in the following key that have 12 (rarely 13) dorsal-fin spines also have more precaudal vertebra than other opistognathids (12 or 13 versus 10 or 11), except *O. darwiniensis* with typically 12+19 vertebrae and 10 or 11 (usually 11) dorsal-fin spines. *Opistognathus darwiniensis* is also exceptional in having a second, irregularly developed, tubed lateral line (often with one or more branches on belly) present along the lower sides near the anal-fin origin. Numbers of dorsal-fin spines and precaudal vertebrae vary widely among percoids, and in the absence of a reasonably supported sister-group hypothesis for the Opistognathidae (see discussion in Gill & Mooi, 1993), polarity of such meristic characters is equivocal. High numbers of spines and precaudal vertebrae could have evolved in the ancestor of the Opistognathidae; that possibility combined with the lack of character state concordance in *O. darwiniensis*, leads me to retain these species in a "catch-basket" *Opistognathus*, the oldest available generic name in the family, pending independent corroborative evidence of monophyly.

Key to Australian jawfishes

1 First 5–9 dorsal-fin spines transversely forked distally (posteriorly spines successively less deeply and more narrowly forked); skin covering spinous dorsal fin forming a broad dorsal hood to accommodate transversely forked spines; segmented anal-fin rays 10 or 11 2

—— Anterior dorsal-fin spines not transversely forked; skin covering spinous dorsal fin not forming a broad dorsal hood; segmented anal-fin rays 10–19 3

2 Posterior edge of opercle and adjacent branchiostegal membranes dark and conspicuous; dorsal, anal, and caudal fins with two, broad dark stripes or bands (Japan, Indonesia, Great Barrier Reef, and New Caledonia) ..... *Stalix histrio* Jordan & Snyder, 1902

—— Posterior edge of opercle and adjacent branchiostegal membranes not conspicuously pigmented; dorsal, anal and caudal fins without dark stripes or bands (western Australia) ..... *Stalix flavida* Smith-Vaniz, 1989

3 Dorsal-fin spines 10 or 11 4

—— Dorsal-fin spines 12 or 13 (rarely 13) 13

4 Body with 2 separate lateral lines, the ventral one irregularly developed along lower side in region of anal-fin origin, often with one or more branches on belly; head covered with close-set, tiny, brown spots and pelvic fins usually strongly barred; precaudal vertebrae 12 or 13 (northwestern Australia) ..... *Opistognathus darwiniensis* Macleay, 1878

—— Body with a single, dorsally positioned lateral line; colour pattern not as above; precaudal vertebrae 10 or 11 5

5 Segmented dorsal- and anal-fin rays 11–13 and 10–12, respectively 6

—— Segmented dorsal- and anal-fin rays 14–20 and 13–19, respectively 8

6 Opercle with a conspicuous dark blotch; scales on belly minute and distinctly embedded; body with about 80–99 oblique scales in longitudinal series; vomerine teeth 1–3; upper gill-rakers 14–17 (eastern Australia) ..... *Opistognathus eximus* (Ogilby, 1908)

—— Opercle without a dark blotch; scales on belly, if present, small to moderate and not distinctly embedded; body with about 41–62 oblique scales in longitudinal series; vomerine teeth absent; upper gill-rakers 9–12 7

7 Spinous dorsal without an ocellus; soft dorsal and anal fins mostly dark with a narrow pale basal stripe; no dark chin bar; outer premaxillary teeth relatively straight and with distinctly blunt tips; nape at least partially scaled (gulfs of Thailand and Carpentaria) ..... *Opistognathus macrolepis* Peters, 1866

—— Spinous dorsal fin with a prominent ocellus; coloration of soft dorsal and anal fins not as above; dark chin bar present; outer premaxillary teeth variously curved and with pointed tips; nape usually naked (western Pacific, including Great Barrier Reef, Fiji and Samoa islands) ..... *Opistognathus* sp. "chinstrap jawfish"

8 Floor of mouth between dentaries and "tongue" dark brown; dorsal fin X, 16–18, rarely 16; body with about 80–99 oblique scale rows in longitudinal series (eastern Australia) ..... *Opistognathus jacksoniensis* Macleay, 1881

—— Floor of mouth between dentaries and "tongue" pale; number of dorsal-fin spines and rays not in above combination; body with about 21–54 oblique scales in longitudinal series 9

9 Posterior end of upper jaw produced as a thin flexible lamina in adults (beginning as a slight posteroventral projection in small juveniles); in at least adult males upper jaw extends to or beyond posterior margin of preopercle and appears somewhat scimitar-shaped; roof of mouth behind upper pharyngeal toothplates with a pair of slightly separated dark blotches; total dorsal-fin elements 25 (rarely 26); lateral-line terminus below verticals from 2nd to 4th segmented dorsal-fin rays (northern Australia) ..... *Opistognathus verecundus* n.sp.

—— Posterior end of upper jaw rigid in adults, without a flexible lamina; upper jaw not extending to posterior margin of preopercle, truncate or moderately rounded but never scimitar-shaped; roof of mouth behind upper pharyngeal toothplates immaculate; total dorsal-fin elements 25–30; lateral-line terminus below verticals from 4th to 17th segmented dorsal-fin rays 10

10 Segmented dorsal- and anal-fin rays 14–16 and 14 or 15, respectively; body naked anterior to a vertical between ultimate spine and 2nd segmented dorsal-fin rays; caudal vertebrae 18 (Great Barrier Reef) ..... *Opistognathus seminudus* n.sp.

—— Segmented dorsal- and anal-fin rays 18–20 and 17–19, respectively; body naked anterior to a vertical between 5th and 7th spines or 6th and 9th segmented dorsal-fin rays; caudal vertebrae 22 or 23 11

11 Body naked anterior to a vertical line from 6th to 9th segmented dorsal-fin rays; lateral line terminus below verticals between 13th and 17th segmented dorsal-fin rays; body with 21–31 oblique scale rows (western Australia) ..... *Opistognathus alleni* n.sp.

—— Body naked anterior to a vertical from 5th to 7th dorsal-fin spines; lateral line terminus below verticals between 4th and 8th segmented dorsal-fin rays; body with 38–51 oblique scale rows 12

12 Spinous dorsal fin with an oblong black spot (encircled by narrow white border) between spines 3–6 that extends slightly onto dorsum; dorsal-fin spines 11; vomerine teeth 2 or 3; sides of body uniformly pigmented (Elizabeth Reef) ..... *Opistognathus elizabethensis* n.sp.

—— Spinous dorsal fin pigmentation not as above; dorsal-fin spines 10; vomerine teeth absent; sides of body with longitudinal row of 7 or 8 large pale spots and a few conspicuous small, black spots (Great Barrier Reef and Coral Sea Plateau) ..... *Opistognathus stigmosus* n.sp.

13 Dorsal fin with 4 or 5 large dark blotches that extend onto dorsum; lateral line terminus below verticals between 10th spine and 5th segmented dorsal-fin ray; 56–80 oblique scale rows in longitudinal series 14

—— Dorsal fin pigmentation not as above; lateral line terminus below verticals between 6th and 13th segmented dorsal-fin ray; 78–129 oblique scale rows in longitudinal series 15

14 Dorsal fin with 4 dark blotches, first blotch extending onto distal half of fin; inner surface of mouth, and skin connecting dentary and maxilla pale; dorsum of head reticulated; total gill-rakers on first arch 26–29; vertebrae 12+19 (northern Australia) ..... *Opistognathus reticeps* n.sp.

—— Dorsal fin with 5 dark blotches, first blotch only on base of fin; much of inner surface of mouth, and skin connecting dentary and maxilla (hidden from view when mouth is closed) darkly pigmented; dorsum of head uniformly pigmented; total gill-rakers on first arch 23 or 24; vertebrae 13+19–21 (northern Australia and southern Papua New Guinea) ..... *Opistognathus latitabundus* (Whitley, 1937)

15 Body with pale reticulate network enclosing irregular tan blotches, each of which has one to several small, dark-brown spots; pectoral-fin base (laterally and mesially) with a conspicuous dark spot about half diameter of eye; pelvic and anal fins white; vertebrae 13+18 (northwestern Australia) ..... *Opistognathus reticulatus* (McKay, 1969)

—— Body with no to many dark spots on an otherwise uniformly pigmented body; pectoral-fin base not pigmented as above, either unmarked or typically with tiny black spots; pelvic and anal fins usually brownish, the anal fin with or without small spots; vertebrae 12+18–20 (usually 19) 16

16 Body with numerous small spots, especially on dorsum of head; pectoral fin with several to many tiny dark spots; background coloration of body pale (in life, light tan), darker dorsally (Waigeo and Queensland to Darwin, Australia) ..... *Opistognathus papuensis* Bleeker, 1868

—— Body usually without spots, if present, spots relatively large and sparse; pectoral fin typically unspotted; background coloration of body dark brown (Western Australia) ..... *Opistognathus inornatus* Ramsay & Ogilby, 1887

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Toxotes kimberleyensis, a New Species of Archerfish (Pisces: Toxotidae) from Fresh Waters of Western Australia

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ABSTRACT. *Toxotes kimberleyensis* n.sp. is described from 22 specimens, 52.5–126.3 mm SL, collected from freshwater streams in the Kimberley region of northwestern Australia. It was previously identified as *Toxotes oligolepis* Bleeker, a poorly known species from Indonesia. However, re-examination of Bleeker's type specimen indicates significant differences between the two species relating to the length of the dorsal spines, and lateral-line scale count. A key to the seven species of *Toxotes* is provided.

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The perciform family Toxotidae is well known for its ability to shoot down insects from overhanging vegetation with a jet of water squirted from the mouth. The family contains a single genus, *Toxotes*, which ranges from India to Vanuatu, and northern Australia to the Philippines. These fishes are common inhabitants of mangrove-lined estuaries and freshwater streams. Allen (1978, 2001) recognized six species: *T. blythi* Boulenger, *T. chatareus* (Hamilton), *T. jaculatrix* (Pallas), *T. lorentzi* Weber, *T. microlepis* Günther, and *T. oligolepis* Bleeker. The last mentioned species was described from a single specimen from Indonesia with questionable collecting data, but most likely originated from the island of Buru. Although the population from the Kimberley district of Western Australia was previously identified as *T. oligolepis*, I stated in the 1978 review that "there is a possibility that it may represent a distinct species" due to its greater number of lateral-line scales and deeper body. An opportunity to re-examine Bleeker's holotype of *T. oligolepis* and directly compare it with specimens from the Western Australia in 2001 revealed additional significant differences. Therefore, it is concluded that the population from Western Australia is a distinct new species, which is described herein.

Materials and methods

Proportional measurements were taken with dial calipers to the nearest 0.1 mm. The methods for counts and measurements are as follows: the last dorsal and anal soft rays are split at the base and are counted as a single element; principal caudal rays include all rays extending to the posterior margin of the caudal fin; lateral-line scale counts include all tubed scales between the upper edge of the gill opening to the caudal-fin base; horizontal scale rows above and below the lateral line are counted below the dorsal-fin origin and above the anal-fin origin respectively; circumpeduncular scales include the total number of transverse scale rows on both sides of the narrowest portion

Fig. 1. *Toxotes kimberleyensis*, holotype, 126.3 mm SL, Plain Creek, Western Australia.

of the caudal peduncle; gill-raker counts pertain to the first gill arch and are presented as separate upper and lower arch elements. Standard length (SL) is measured from the tip of the upper jaw to the tail base, also indicated by the line of flexure at the hypural base; head length is taken from the front of the upper lip to the posterior end of the opercular membrane; body depth is the maximum depth measured from the base of the dorsal spines, and body width the greatest width just posterior to the gill opening; eye diameter is the greatest bony diameter of the orbit, and interorbital width is the least bony width; snout length is measured from the front of the upper lip to the fleshy anterior edge of the orbit; upper jaw length is the straight line measurement between the snout tip and posterior edge of the maxilla; predorsal, prepelvic, and preanal distances are also taken from the front of the upper lip to the origin of the respective fins; caudal peduncle depth is the least depth of the tail base and its length is measured between two verticals, one from the base of the last anal ray and the other at the line of flexure on the hypural (caudal-fin base); lengths of fin spines and soft rays of fins are measured in a straight line from the level of their basal articulation.

Counts and proportions appearing in parentheses apply to the paratypes. Type specimens are deposited at the Australian Museum, Sydney (AMS), Northern Territory Museum, Darwin (NTM), and Western Australian Museum, Perth (WAM). The type specimen of *Toxotes oligolepis* was examined at the National Museum of Natural History (RMNH), Leiden, The Netherlands.

Toxotes kimberleyensis n.sp.

Figs. 1, 2; Tables 1–3

Type material. HOLOTYPE: WAM P.25039-002, 126.3. mm SL, Plain Creek Gorge, Beverley Springs Station, West Kimberley District, Western Australia (16°35'S 125°30'E), hook and line near surface, G. Allen and W. Bailey, 1 September 1974. PARATYPES: AMS I.42570-001, 107.5 mm SL, collected with holotype; NTM S.15530-001, 102.4 mm SL; WAM P.25039-001, 3 specimens, 98.2–109.2 mm SL, collected with holotype; WAM P.25437-001, 65.5 mm SL, May River, Western Australia (17°21'S 124°00'E), rotenone, B. Hutchins and A. Chapman, 26 July 1975; WAM P.25440-006, 15 specimens, 52.5–92.8 mm SL, Lennard River, Western Australia (17°20'S 124°40'E), rotenone, B. Hutchins and A. Chapman, 27 July 1975.

Diagnosis. A species of *Toxotes* with the following combination of characters: dorsal rays V, 11–13 (usually 11–12); longest (fourth and fifth) dorsal-fin spines about equal in length and shorter than longest soft dorsal ray in adults; anal rays III,14–16 (usually 15); pectoral rays 12–13; tubed lateral-line scales 28–33 (usually 30–31); diagnostic colour markings consisting of 4–5 wedge-shaped black bars or saddles without intervening small spots.

Description. Dorsal rays V,12 (11–13), anal rays III,15 (14–16); pectoral rays 12 (12–13); principal caudal rays 17; gill-rakers on lower limb of first branchial arch 7 (6 or 7), usually a single raker on upper limb; tubed lateral-line scales 31 (28–33); horizontal scale rows above lateral-line to dorsal fin origin 3; horizontal scale rows below lateral line to anal fin origin 9 (8–10); circumpeduncular scale rows 16 (17–16).

Body depth 2.2 (2.1–2.3) in standard length; maximum body width 2.4 (2.2–2.6) in depth; head length contained

Fig. 2. *Toxotes kimberleyensis*, about 150 mm total length (G. Schmida photo).

3.0 (2.6–2.9) in standard length; snout 4.0 (3.5–4.3), eye 3.5 (3.3–3.9), interorbital width 3.0 (2.9–3.3), upper jaw length 1.9 (2.0–2.3); least depth of caudal peduncle 2.5 (2.5–3.1), length of caudal peduncle 3.0 (2.7–3.7), all in head length.

Mouth large, the lower jaw protruding; mouth opening oblique, angle of jaw about 42 degrees from horizontal axis of body; maxilla slender and scaly, without supplemental bone, reaching a vertical level with middle of eye; fine villiform teeth on jaws, vomer, and palatines; pair of prominent nasal opening on each side of snout just anterior to eye; anterior nostrils in short fleshy tube; scattered sensory pores evident on interorbital region, tip of snout, margin of preopercle, sub-preorbital series, and ventral surface of lower jaw; free edges of preopercle and opercular series smooth except lower margin of preopercle very finely crenate.

Scales of head and body very finely ctenoid, but smooth to touch; head fully scaled except for small naked patch on central rear margin of preopercle; dorsal and anal fins with well-developed basal scaly sheath and small scales extend nearly to margin of fins; outer base of pectoral fin scaled, but axil naked; pelvic axillary scale about half length of pelvic fin; innermost pelvic-fin ray attached to abdomen by membrane.

Lateral line nearly complete (except usually interrupted

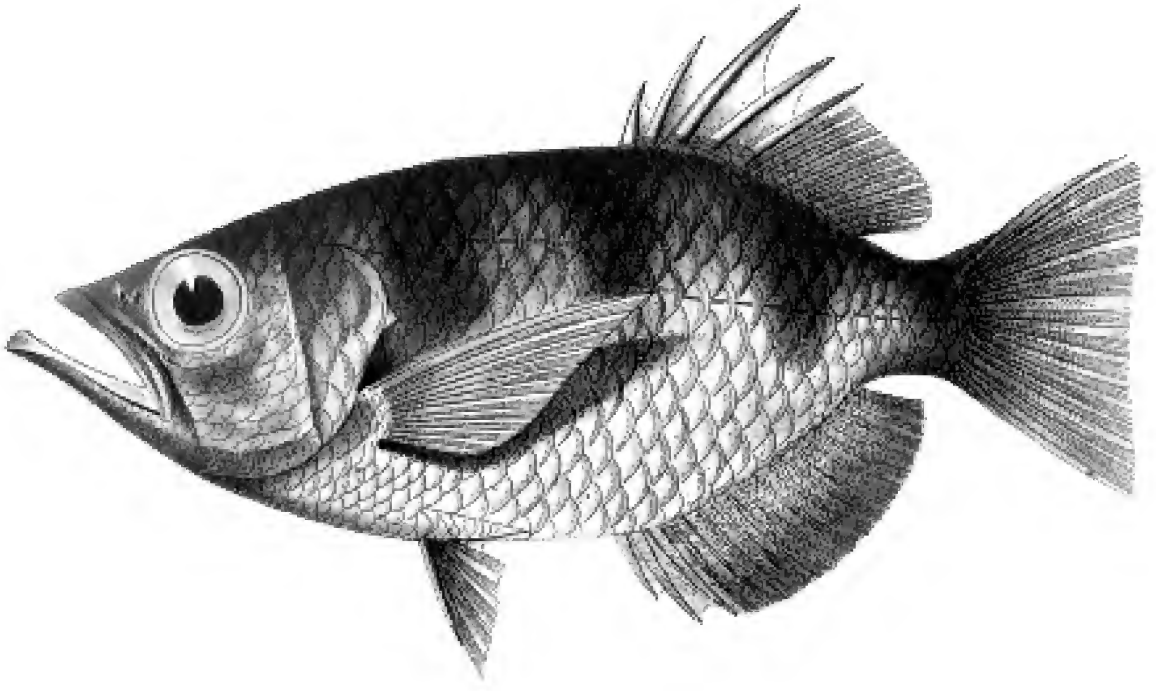

Fig. 3. *Toxotes oligolepis*, 102 mm SL, L. Speigler drawing from Bleeker (1875–1878).

Table 1. Proportional measurements of selected type specimens of *Toxotes kimberleyensis* as percentage of the standard length.

character	holotype	paratypes					
	WAM P.25039-002	WAM P.25039-001	AMS I.42570-001	WAM P.25039-001	NTM S.15530-001	WAM P.25039-001	WAM P.25440-006
standard length (mm)	126.3	109.2	107.5	106.2	102.4	98.2	76.7
body depth	45.3	42.6	47.4	45.7	43.2	43.3	47.3
body width	18.7	19.0	21.0	18.8	18.6	18.3	19.4
head length	33.4	34.6	38.3	35.2	37.2	34.9	37.2
snout length	8.3	8.0	11.1	9.2	8.7	9.7	9.6
eye diameter	9.7	9.2	10.0	10.8	9.9	9.3	9.5
interorbital width	11.2	11.3	10.9	12.0	11.4	11.9	12.0
upper jaw length	17.6	16.7	17.8	16.9	18.2	17.6	17.1
depth of caudal peduncle	13.5	13.1	14.3	11.3	13.5	13.4	14.5
length of caudal peduncle	11.1	12.8	12.5	10.9	12.7	11.7	10.2
predorsal distance	55.9	57.2	62.3	55.1	57.1	58.0	57.8
preanal distance	67.5	67.2	75.1	68.1	68.2	67.6	70.3
prepelvic distance	44.3	44.9	49.3	45.0	46.2	44.5	46.7
length of dorsal-fin base	36.3	35.1	38.6	34.8	32.7	33.6	34.3
length of anal-fin base	31.8	31.5	34.9	32.1	31.1	31.4	31.0
pectoral-fin length	28.8	29.3	34.0	29.0	30.6	29.5	28.2
pelvc-fin length	15.0	17.7	19.1	14.2	17.6	16.6	17.7
pelvic-fin spine length	12.9	12.2	12.5	12.8	12.7	12.1	13.7
1st dorsal spine	7.0	7.3	7.7	7.6	7.2	6.6	8.1
2nd dorsal spine	12.7	13.9	12.2	11.9	12.6	12.9	15.8
3rd dorsal spine	17.2	16.9	16.7	15.5	18.5	19.5	16.6
4th dorsal spine	17.8	17.5	18.0	17.9	19.8	20.8	18.9
5th dorsal spine	17.8	17.7	17.7	19.6	20.2	21.7	18.0
longest soft dorsal ray	19.7	19.0	19.1	20.2	20.8	23.1	17.6
1st anal spine	7.0	7.1	7.1	7.3	7.9	7.3	7.2
2nd anal spine	12.0	11.0	11.6	10.9	13.0	12.7	11.6
3rd anal spine	17.2	16.9	17.1	17.7	19.5	18.2	15.5
longest soft anal ray	22.4	22.9	23.9	21.7	24.5	24.5	20.6
caudal-fin length	28.7	26.4	28.2	26.8	30.8	27.5	27.4

by 1–2 tubeless scales above pectoral fin), consisting of simple unbranched tubes, extending from upper rear corner of operculum to hypural base, usually with a pronounced dorsal inflection above pectoral region.

Origin of dorsal fin about level with origin of anal fin, on rear half of body; first dorsal spine 4.8 (4.4–5.0) in head length; spines of dorsal fin gradually increasing in length and thickness to fourth spine, fourth and fifth dorsal spines about equal in length; fifth dorsal spine 1.9 (1.6–2.1) in head length; longest (first two) soft dorsal rays about equal or slightly shorter than tallest dorsal spines, 1.7 (1.5–2.1) in head length; anal spines progressively increasing in length; first anal spine 4.8 (4.7–5.4), and third anal spine 1.9 (1.9–2.4), both in head length; length of dorsal-fin base 0.9 (1.0–1.1), of anal-fin base 1.0 (1.1–1.2), both in head length; caudal fin truncate to very slightly emarginate, its length 1.2 (1.2–1.4) in head length; pectoral reaching a vertical through origin of dorsal and anal fins, the longest ray 1.2 (1.1–1.3) in head length; pelvic fins short, longest ray falling well short of anal fin origin when depressed, 2.2 (2.0–2.5) in head length.

Preserved coloration (in alcohol). Ground colour yellowish white with slight silvery sheen, grading to brown on dorsal

Table 2. Dorsal and anal fin-ray counts for type specimens of *Toxotes kimberleyensis* (frequency of each count is indicated in bottom row).

	dorsal rays			anal rays		
counts	11	12	13	14	15	16
frequency	7	13	2	6	15	1

Table 3. Pectoral fin-ray and lateral-line scale counts for type specimens of *Toxotes kimberleyensis* (frequency of each count is indicated in bottom row).

	pectoral rays		lateral-line scales				
counts	12	13	28	29	30	31	33
frequency	6	16	1	1	4	15	1

surface; a series of five diffuse blackish bars, primarily on upper side, the last (on caudal peduncle) very faint; dorsal and anal fins dusky blackish, with pale central band; caudal-fin membranes dusky blackish; pelvic fins pale tan; pectoral fins translucent with uppermost rays dusky blackish. The paratypes are similar except the dark bars are more vivid and strongly contrasted. In addition, the last bar (on caudal peduncle) is frequently reduced to a small rounded spot, especially in the smallest specimens.

Live coloration (from 35 mm transparency): overall silvery white with five black bars or vertically ovoid spots between eye and caudal fin base; fins generally transparent to whitish in young to dusky blackish (especially dorsal and anal) in adults.

Etymology. The species is named *kimberleyensis* with reference to the type locality. Major surveys of northern Australian freshwater fishes by the author and co-workers over the past 3 decades indicate that it is restricted to the Kimberley region.

Remarks. Bleeker (1876) described *Toxotes oligolepis* from a single specimen, 111.7 mm SL. The precise collection locality is uncertain, but according to Bleeker and Weber & de Beaufort (1936), was probably the island of Buru in the Molucca Islands, Indonesia. Specimens from the Kimberley district of Western Australia were previously identified (Allen, 1978) as *T. oligolepis* based largely on colour pattern similarity. However, I recently had an opportunity to re-examine Bleeker's holotype at RMNH and compare it with specimens from Western Australia. Several significant differences were noted. The dorsal spines of *T. oligolepis* are notably taller and stronger than those of Australian fish. The third dorsal spine is the tallest and strongest, and is significantly higher than the soft portion of the dorsal fin. In contrast the fourth and fifth spines are the tallest and strongest in the Australian fish and are about equal in height or lower than the soft part of the dorsal fin. In addition, the Australian specimens have a higher lateral-line scale count (30–31) in comparison to *T. oligolepis*. Although the holotype of *T. oligolepis* has damaged and missing scales, close inspection of scale pockets reveals a count of about 25. This count is further corroborated by the illustration of *T. oligolepis* in Bleeker's Atlas Ichthyologique (1875–1878, pl. 363, Fig. 1), which is reproduced here as Fig. 3.

Toxotes kimberleyensis is known only from a relatively small area of the western Kimberley district of Western Australia, including the Fitzroy, Meda, May, and Isdell Rivers (Allen *et al.*, 2002). It is especially common in the Fitzroy system, but appears relatively scarce elsewhere. Unlike *T. chatareus* and *T. jaculatrix* that are found in coastal areas of the Kimberley, frequently in brackish water (or marine conditions in the case of *T. jaculatrix*), *T. kimberleyensis* is strictly confined to freshwater. It penetrates well inland, at least as far as Geike Gorge National Park in the Fitzroy system, or approximately 300 km upstream from the sea. The species has an affinity for deeper pools where it swims near the surface, patrolling the shoreline for insects.

The following key provides characters for differentiating the seven known species of *Toxotes* (modified from Allen, 1978).

Key to the species of *Toxotes*

1 Dorsal spines 4: series of 4–5 black bars on upper sides (widespread, India to Vanuatu) ..... *T. jaculatrix*

—— Dorsal spines normally 5; colour variable with either bars, spots, or irregular stripes on sides, or colour uniform without dark markings 2

2 Lateral-line scales usually 25–38 3

—— Lateral-line scales usually 39–50 5

3 Colour pattern consisting of a series of 6–7 alternating, large and small black spots (widespread, India to Papua New Guinea and northern Australia) ..... *T. chatareus*

—— Colour pattern consisting of a series of 4–5 wedge-shaped, black bars or saddles without intervening small spots 4

4 Third dorsal spine notably taller and thicker than fourth and fifth spines; spinous portion of dorsal fin much higher than soft portion of fin (Buru Island, Indonesia) ..... *T. oligolepis*

—— Third dorsal spine shorter and thinner than fourth and fifth spines; spinous portion of dorsal fin shorter or about equal in height compared to soft portion of fin (Kimberley region of Western Australia) ..... *T. kimberleyensis*

5 General coloration in preservative uniform tan or brown without markings (may have about 10 faint, narrow bars on upper side in life); lateral line more or less straight; gill-rakers on lower limb of first arch 2–4, usually 3 (northern Australia and New Guinea) ..... *T. lorentzi*

—— General coloration not uniform tan or brown without markings, consisting of ovate spots or 4–5 elongate black bars or triangular saddles interspersed with smaller black spots on upper back; lateral line arched over pectoral region; gill-rakers on lower limb of first arch usually 5–8 6

6 Colour pattern consisting of irregular horizontally ovate spots on a light background; irregular dark stripes on soft portion of dorsal fin (Burma) ..... *T. blythi*

—— Colour pattern consisting of 4–5 vertically elongate, black bars or triangular saddles interspersed with smaller black spots on upper back; soft portion of dorsal fin with pair of large black spots (Thailand, Sumatra, and Borneo) ..... *T. microlepis*

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Cheilodactylus (Goniistius) francisi, A New Species of Morwong (Perciformes: Cirrhitoidea) from the Southwest Pacific

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ABSTRACT. A new morwong, *Cheilodactylus (Goniistius) francisi*, is recognized from southwest Pacific Islands (Lord Howe Island, Middleton Reef, Kermadecs, and probably Elizabeth Reef, Norfolk Island, and New Caledonia). Distinguishing features from *C. (G.) vittatus* (Hawaiian Islands) comprise gill-raker counts, caudal-fin coloration, and notable molecular divergence.

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Morwongs are cirrhitoid fishes of subtropical and temperate marine nearshore waters, occurring throughout the Southern Hemisphere, northwest Pacific, and Hawaiian Islands (Smith, 1980; Randall, 1983). They are usually solitary, occurring demersally over reef substrates and feeding on small benthic invertebrates (Sano & Moyer, 1985; Cappo, 1995; McCormick, 1998). The taxonomy of morwongs and other cirrhitoids is highly contentious at the levels of species recognition, generic assignment, and familial allocation (Allen & Heemstra, 1976; Smith, 1980; Randall, 1983; Lamb, 1990; Greenwood, 1995; Burridge, 1999; Burridge & White, 2000; Burridge & Smolenski, 2004).

Cheilodactylus (Goniistius) vittatus Garrett, 1864, thought endemic to the Hawaiian Islands, was provisionally recognized from New Caledonia and Lord Howe Island in the southwest Pacific based on photographs of live specimens viewed by Randall (1981, 1983), although he noted that positive identification should await a direct comparison of specimens. This species was later documented at the Kermadec Islands by Francis *et al.* (1987), but based on the key developed by Randall (1983), that may not be sensitive to any morphological distinctiveness of southwest Pacific specimens. A recent study of molecular variation within *Goniistius* Gill, 1862 revealed that divergence of Hawaiian *C. (G.) vittatus* from a putatively conspecific southwest Pacific individual was equivalent to that observed during interspecific comparisons within the subgenus (Burridge & White, 2000). Consequently, the first morphological comparison of Hawaiian and southwest Pacific "*vittatus*" individuals has been conducted, and additional molecular data have been collected to further assess the taxonomic significance of genetic divergence observed across the equator; a new species from the southwest Pacific is described herein.

Materials and methods

To my knowledge, only seven specimens of southwest Pacific "*vittatus*" have been deposited in museum collections. One Kermadec Islands individual is deposited in Te Papa Tongarewa (Museum of New Zealand, NMNZ P17846). Two specimens have been obtained from Middleton Reef (Australian Museum, Sydney, AMS I.27134-003, AMS I.27139-006). One specimen has been obtained from Lord Howe Island (AMS I.17357-001). This was one of two specimens from Lord Howe Island reported

as *C. gibbosus* Richardson, 1841 by Allen *et al.* (1976), but was subsequently incorrectly reidentified as *C. (G.) vestitus* (Castelnau, 1879); the other AMS specimen actually is *C. vestitus* (J.M. Leis, pers. comm.). Three specimens were recently collected from Lord Howe Rise, southeast of the Island, as part of the NORFANZ expedition (AMS I.42728-001, NMNZ P39102, CSIRO H6034-10). The fate of the two Noumea Aquarium specimens described by Randall (1981, 1983) could not be traced.

Measurements of specimens follow the methods employed by Randall (1983) during the most recent revision of *Goniistius*. Counts and proportions of the paratypes, where different from the holotype, are given in parentheses along with the modal value, as appropriate. Collection of partial mitochondrial cytochrome *b* DNA sequence data from additional Hawaiian *C. (G.) vittatus* individuals was performed following Burridge & White (2000), to better assess the magnitude of molecular divergence from the only southwest Pacific individual available for DNA analysis.

Cheilodactylus (Goniistius) francisi n.sp.

Fig. 1

Goniistius gibbosus.—*non* Richardson, 1841 (Allen *et al.*, 1976, Lord Howe Island)

Cheilodactylus vittatus.—*non* Garrett, 1864 (Randall, 1981, 1983, Lord Howe Island and New Caledonia; Francis *et al.*, 1987, Kermadec Islands; Gill & Reader, 1992, Elizabeth and Middleton Reefs).

Cheilodactylus sp.—Francis, 2001 (Kermadec Islands).

Type material. HOLOTYPE, AMS I.17357-001, 199.8 mm SL, Lord Howe Island, 100 m off Phillip Point (31°32'S 159°04'E), 20–25 m depth, poison and spear, G.R. Allen, B. Goldman, D.F. Hoese, J.E. Randall, B.C. Russell, W.A. Starck, 5–16 February 1973. PARATYPES: NMNZ P17846, 233.6 mm SL, Kermadec Islands, northeast corner of Cheeseman Island (30°30'S 178°34'W), spear, M.P. Francis, 14 October 1985; AMS I.27134-003, 256.4 mm SL, Middleton Reef, shallow reef front (29°27.2'S 159°06.8'E), 9 m depth, rotenone, S.E. Reader, A.C. Gill, D. Leadbitter, M. Cordell, 4 December 1987; AMS I.27139-006, 95.0 mm SL, outer western edge of Middleton Reef (29°29.2'S 159°04.1'E), 6 m depth, rotenone, A.C. Gill, S.E. Reader, D. Leadbitter, M. Cordell, 4 December 1987; NMNZ P39102, 273.7 mm SL, off Ball's Pyramid, Lord Howe Rise (31°48.60'–46.70'S 159°20.74'–21.02'E), 66–88 m depth, Orange Roughy Trawl, NORFANZ expedition team, 25 May 2003; AMS I.42728-001, 255.5 mm SL, same collection details as previous; CSIRO H6034-10, 257.5 mm SL, same collection details as previous.

Diagnosis. Dorsal-fin rays XVI,31 (XVI–XVII,31–34, usually XVII,33); anal-fin rays III,8; lateral-line scales 62 (64–66, usually 64); gill-rakers 6+14 (5–6+15–16, usually 5+15); depth of body 2.83 (2.57–2.76) in SL; head length 3.57 (3.48–3.65) in SL; fourth dorsal spine highly pronounced, 1.13 (0.83–1.61) in head length; third dorsal spine 4.76 (2.98–6.31) in fourth dorsal spine; pectoral fins 3.47 (2.94–3.57) in SL; pelvic fins reaching but not extending beyond anus (not reaching, reaching, or extending beyond anus), 5.55 (4.55–5.81) in SL; prominent bony knobs present anteriorly on maxilla and prefrontal; coloration dominated by dark diagonal bands, three on the head, one from the anterior origin of the dorsal fin to the pelvic fin, and one from behind the fourth dorsal spine to the lower lobe of the caudal fin; upper lobe of caudal fin with black tip.

Description. Dorsal-fin rays XVI,31 (XVI–XVII,31–34, usually XVII, 33); anal-fin rays III,8; pectoral-fin rays 13 (13–14, usually 14), the upper two unbranched, the next 6 (5–6, usually 6) branched, and the lower 5 (5–6, usually 6) simple, thickened, and elongated beyond the fin membrane (i.e. ii, 5–6, v–vi); pelvic-fin rays I,5; principal caudal-fin rays 17, the uppermost and lowermost unbranched, branched rays 8+7; lateral-line scales 62 (64–66, usually 64); scales above lateral line to middle of spinous portion of dorsal fin 10; scales below lateral line to origin of anal fin 18 (17–19, usually 18); gill-rakers 6+14 (5–6+15–16, usually 5+15); fourth dorsal spine highly pronounced, 1.13 (0.83–1.61) in head length; third dorsal spine 4.76 (2.98–6.31) in fourth dorsal spine; pectoral fins 3.47 (2.94–3.57) in SL; coloration dominated by dark diagonal bands, three on the head, one from the anterior origin of the dorsal fin to the pelvic fin, and one from behind the fourth dorsal spine to the lower lobe of the caudal fin; upper lobe of caudal fin with black tip; circumpeduncular scales 28 (25–27, usually 27); branchiostegal rays 6.

Body deep, greatest depth 2.83 (2.57–2.76) in SL, and compressed, width 3.18 (2.64–3.34) in depth; head length 3.57 (3.23–3.65) in SL; nape strongly elevated; dorsal profile of snout forming angle slightly greater than 45° to the horizontal, snout length 3.20 (2.24–3.23) in head; orbit diameter 4.15 (3.67–4.77) in head; interorbital space broadly flat medially, the edges convex, the least width 4.21 (3.43–4.72) in head; caudal peduncle slender, the least depth 3.21 (3.22–3.70) in head, and long, the peduncle length 1.13 (0.90–1.15) in head.

Mouth small, somewhat ventral on head, the upper lip projecting, the maxilla reaching a vertical through posterior nostril (or between posterior nostril and centre of orbit); lips thick, fleshy, and smooth; small slender villiform teeth in bands in jaws; pair of bony knobs anterior to orbit, one above each posterior nostril, and a second shorter pair, anteriorly on snout just above upper lip; opercle with a single flat feeble spine posteriorly; nostrils large, both anterior to centre of orbit; anterior nostril elliptical, the upper part covered by a flap from posterior margin and the lower part covered by a flap from the anterior margin, fringed with 8 (up to 11) and 3 (up to 3) cirri respectively; posterior nostril round, diagonally above and behind anterior nostril; pores of lateralis system on head inconspicuous; gill-rakers short, the longest about half the length of the longest gill filament on first arch.

Scales cycloid; scales on head very small, the height of the exposed part about one-sixth height of largest scales on side of body; scales dorsally on head extending forward to above anterior nostril; scales on cheeks extending anteriorly nearly to corner of mouth; snout, lips and ventral part of head naked; lateral line slightly arched above pectoral fin, becoming progressively closer to dorsal contour of body posteriorly, at rear base of dorsal fin it is separated from fin by only 2 scale rows; lateral-line scales small, the exposed part about one-third height of adjacent scales; scaly sheath at base of dorsal fin about half the height of last dorsal spine, comprising 2 scale rows except near the junction of spinous and soft rayed sections, where 3 rows are present; scaly sheath at base of anal fin comprising 1 scale row anteriorly and 1–2 scale rows posteriorly; small scales basally on pectoral fins; no scales in axil of pectoral fins; a few rows of small scales basally on pelvic fins.

Origin of dorsal fin on a vertical from posterior edge of orbit; anterior three dorsal spines short, 12.17 (10.12–13.10),

Fig. 1. Holotype of *Cheilodactylus (Goniistius) francisi* n.sp. (AMS I.17357-001, 199.8 mm SL), collected from Lord Howe Island. Scale 1 cm.

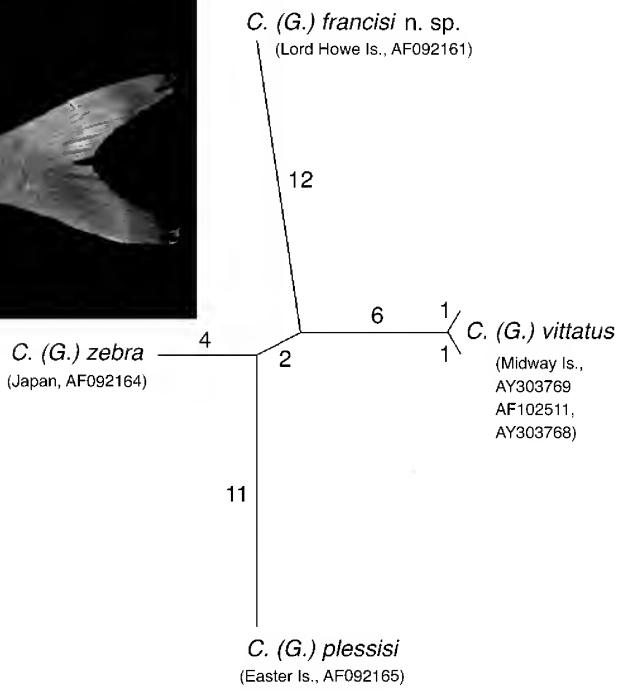

Fig. 2. One of two equally-most parsimonious trees (length = 37 steps) depicting molecular divergence among *C. (G.) francisi* n.sp., *C. (G.) vittatus*, and related species of *Goniistius*, based on partial mitochondrial cytochrome *b* DNA sequences (402 bp). Numbers on branches reflect the frequency of character-state changes, and GenBank accession numbers are listed for each sequence.

7.89 (7.20–9.31), and 5.38 (4.35–5.32) in head; fourth dorsal spine longest, about three times the length of the third spine, length 1.13 (0.83–1.61) in head; remaining dorsal spines progressively shorter, the last 6.36 (4.17–9.31) in head; first dorsal ray almost twice length of last dorsal spine, the ninth (seventh-tenth, usually ninth) dorsal ray longest, 3.50 (3.11–3.87) in head; origin of anal fin below base of ninth or tenth dorsal ray, less than orbit width from anus; first, second and third anal spines 10.98 (9.85–16.23), 3.50 (3.33–4.97), and 3.24 (3.19–4.13) in head, respectively, longest spine about one-third longest anal fin ray; anterior part of soft portion of anal fin about three times longer than posterior, the second ray longest, 1.42 (1.51–1.86) in head; caudal fin 1.08 (0.89–1.53) in head; strongly forked, caudal concavity 2.04 (1.72–2.72) in head; tenth pectoral ray longest (ninth or tenth, usually tenth), 3.47 (2.94–3.56) in SL; upper margin of pectoral fin 6.17 (5.09–6.45) in SL; origin of pelvic fin below base of eleventh or twelfth dorsal spine; pelvic fins reaching but not extending beyond anus (not reaching, reaching, or extending beyond anus), 5.55 (4.55–5.81) in SL.

Preserved coloration of holotype (Fig. 1) and paratypes in ethanol is pale to light brown with dark brown bands; head with two dark bands across interorbital, two on cheek (one from orbit, towards pectoral fin base, the other from below eye to ventroanterior part of thorax); area around upper and lower jaws dark brown; body with one band from nape through axil of pectoral fin to pelvic fin, a second band from first 3 spines of dorsal fin, beneath distal part of pectoral fin, to ventral surface between origin of pelvic fins and anus, and a third band from the fifth dorsal spine to lower lobe of caudal fin, somewhat discontinuous; dorsal fin pale except for the two dark bands extending into spinous portion; anal fin and pectoral fins pale; pelvic fins dark brown; caudal fin upper lobe pale except for black tip, lower lobe entirely dark brown.

Live coloration depicted in Francis (2001, pl. 98).

In addition to the holotype and paratypes of *C. (G.) francisi* n.sp., counts of gill-rakers (6 + 16), dorsal (XVI, 34), anal (III, 8), and pectoral (14, probably ii, 6, vi) fin rays from a 176 mm SL specimen collected at Lord Howe Island (22 April 1997), but not retained, were made by M.P. Francis (NIWA, Wellington, New Zealand). DNA from this specimen was compared against Hawaiian *C. (G.) vittatus* during this study and that of Burridge & White (2000).

Comparisons. Based on data presented by Randall (1983) for *C. (G.) vittatus* from the Hawaiian Islands, and concurrent examination of five such individuals (Bernice P. Bishop Museum, BPBM 5584, 8778, 10061, 11983, 20883; holotype lost according to Randall, 1983), *C. (G.) francisi* n.sp. differs from *C. (G.) vittatus* in the number of upper limb gill-rakers, with the former having 5–6 and the latter 6–8. Only one of 16 *C. (G.) vittatus* specimens examined by Randall (1983) had 6 upper limb rakers, and all of the specimens examined during this study had 7, except one with 8 (BPBM 11983). In contrast to the statement by Randall (1981, 1983), the colour of southwest Pacific "*vittatus*" individuals is not the same as that for the Hawaiian *vittatus*, and this is apparent from the live photographs presented by Randall *op cit.* A black tip to the upper lobe of the caudal fin distinguishes *C. (G.) francisi* n.sp. According to Randall (1983) the tip "may be dusky" in *C. (G.) vittatus*, but such was not observed among the Hawaiian specimens examined herein, or photographs of live individuals viewed by the author, and it is clearly black in *C. (G.) francisi* n.sp. (Randall, 1983, figs. 11 & 12; Francis, 2001, pl. 98). Similarly, the most posterior diagonal dark band on *C. (G.) francisi* n.sp. extends across the caudal peduncle and covers the entire lower lobe of the caudal fin (Fig. 1; Randall, 1983, figs. 11, 12; Francis, 2001, pl. 98), whereas in *C. (G.) vittatus* this band terminates posteriorly at the peduncle (e.g., Jordan & Evermann, 1973, pl. 54). *Cheilodactylus (G.) francisi* n.sp. differs from the other members of *Goniistius* in the features used by Randall (1983) to distinguish *C. (G.) vittatus*.

Based on partial mitochondrial cytochrome *b* DNA sequences, the level of molecular divergence (proportion of differences among 402 nucleotide characters) between one Lord Howe Island individual of *C. (G.) francisi* n.sp. and three Hawaiian individuals of *C. (G.) vittatus* was 4.48–4.73%. This level of divergence is similar in magnitude to that observed between either of these species and their phylogenetically-nearest relatives within *Goniistius, C. (G.) zebra* Döderlein, 1883 and *C. (G.) plessisi* Randall 1983, representing 2.98–5.72% (phylogenetic relationships according to Burridge & White, 2000). In contrast, divergence among the three Hawaiian individuals of *C. (G.) vittatus* was an order of magnitude smaller, 0.25–0.50%. Genetic variation among these taxa is depicted in Fig. 2. Thus, the levels of molecular divergence between *C. (G.) francisi* n.sp. and *C. (G.) vittatus* are consistent in magnitude with other interspecific comparisons within *Goniistius*, and much higher than intraspecific divergence within *C. (G.) vittatus* (see also Johns & Avise, 1998, for a wider perspective of interspecific cytochrome *b* variation among congeneric fishes). Despite the low availability of material from these species, it is unlikely that the intraspecific variation detected for *C. (G.) vittatus* is sufficiently underestimated such that the divergence from *C. (G.) francisi* n.sp. is insignificant. All three individuals of *C. (G.) vittatus* were collected from Midway Island, located at the northwest extremity of the Hawaiian Island chain. Given the comparatively high abundance of *C. (G.) vittatus* at this locality, the greater geological age of the northwestern islands in the Hawaiian chain, and their oceanographically "upstream" placement relative to the southeast Hawaiian islands, it is likely that Midway Island represents one of the greatest sources of genetic variation within *C. (G.) vittatus*.

Etymology. This species is named in recognition of the contributions made by Malcolm Francis to the biogeography of southwest Pacific fishes, and for the provision of tissue samples from this rarely encountered taxon for my genetic research.

Distribution. *Cheilodactylus (G.) francisi* n.sp. is known from the type localities, Lord Howe Island, Lord Howe Rise, Middleton Reef, and the Kermadec Islands, and probably also represents the reports of *C. (G.) vittatus* from New Caledonia (Randall, 1981, 1983) and Norfolk Island (Francis, unpublished) based on live photographs, and Elizabeth Reef based on visual observations (Gill & Reader, 1992). The species appears to be common at the Kermadecs (Francis *et al.*, 1987) and Elizabeth and Middleton Reefs (Gill & Reader, 1992).

Remarks. Although placement of non-South African taxa within *Cheilodactylus* Lacepède, 1803 appears invalid based on morphological and molecular characters (Burridge & Smolenski, 2004), such an assignment is followed for *C. (G.) francisi* n.sp. pending revision of these and other cirrhitoids.

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Eviota hoesei and *E. readerae*, New Species of Fish from the Southwest Pacific, With Comments on the Identity of *E. corneliae* Fricke (Perciformes: Gobiidae)

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ABSTRACT. *Eviota hoesei* n.sp. is described from specimens from New Caledonia, Lord Howe Island (type locality), Norfolk Island, and Middleton and Elizabeth Reefs. It is distinguished from congeners in having the following character combination: dorsal-fin rays usually VI + I,9; anal-fin rays usually I,8; at least some pectoral-fin rays branched; cephalic sensory-pore system pattern 2; base of pectoral fin with two diffuse to prominent dark spots; fifth segmented pelvic-fin ray present, usually about 1/10 length of fourth ray; and 6 subcutaneous bars/spots on lower postanal trunk. *Eviota readerae* n.sp. is described from specimens from Middleton (type locality) and Elizabeth Reefs. It is distinguished from congeners in having the following combination of characters: dorsal-fin rays VI + I,9; anal-fin rays I,8; at least some pectoral-fin rays branched; fifth segmented pelvic-fin ray lacking; cephalic sensory-pore system pattern 1; male genital papilla non-fimbriate; 12–13 dark bars or saddles on trunk from origin of spinous dorsal fin to mid peduncular spot, not extending below midline; and pectoral-fin base with prominent circular dark spot dorsally. *Eviota corneliae* Fricke is placed in synonymy with *Trimmatom eviotops* (Schultz).

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Eviota Jenkins (1903) is a genus of small, reef-associated gobiids found throughout the Indo-Pacific. It is distinguished from other gobiid genera by the following combination of characters (Lachner & Karnella, 1980): small adult size (females usually sexually mature at less than 15 mm SL); pelvic fins separate, a fine fragile membrane joining bases, fraenum absent; pelvic-fin rays I,4 or I,5, the fifth segmented ray (when present) a simple rudiment or an unbranched ray; fourth segmented pelvic-fin ray multi-branched; trunk usually with dark subcutaneous spots or bars; first dorsal fin with 6 spines; scales ctenoid, fewer than 30 in lateral series, absent from head,

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nape and base of pectoral fin; and gill opening narrow.

The second author (formerly Susan J. Karnella) published four papers on the systematics of *Eviota* with the late Ernest A. Lachner (Lachner & Karnella, 1978, 1980; Karnella & Lachner, 1981; Jewett & Lachner, 1983). In those papers they recognized 41 valid species, but noted that additional undescribed species were known. They had planned to describe those species, but those plans were never realized. We herein describe two new species, both of which occur within Australian waters and have been listed in faunal checklists. Only six other *Eviota* species have been described since 1983: *E. corneliae* Fricke (1998) (but see below), *E. lacrymae* Sunobe (1988), *E. mikiae* Allen (2001), *E. raja* Allen (2001), *E. rubra* Greenfield & Randall (1999), and *E. susanae* Greenfield & Randall (1999). Our examination of *E. corneliae* reveals that it is not a species of *Eviota*. We therefore discuss the identity of this nominal species. We regard the other five as valid species of *Eviota*.

Materials and methods

We follow Lachner & Karnella (1980) for methods of making counts and measurements and for describing fin morphology and laterosensory pore/neuromast patterns. We use the term "segmented" for the fifth non-spinous ray in the pelvic fin in *Eviota* species, although it usually lacks segmentation when very short. Numbers in parentheses indicate numbers of individuals with a given count; underlined frequencies indicate holotype values. Although all type specimens of *E. hoesei* were checked for diagnostic characters, data for all specimens were not necessarily recorded; therefore frequencies given in the description are based on the holotype and a subset of paratypes. Institutional abbreviations follow Leviton *et al.* (1985).

Eviota hoesei n.sp.

Figs. 1, 2

Eviota sp. cf. *afelei*.—Allen *et al.*, 1976: 430 (Lord Howe Island).
Eviota n.sp. C.—Gill & Reader, 1992: 222 (Elizabeth and Middleton Reefs).

Type material. HOLOTYPE: AMS I.17367-004, 19.7 mm SL, Lord Howe Island, south lagoon reef crest, 31°32'S 159°04'E, 2–3 m, derris dust, D.F. Hoese, February 1973. PARATYPES: AMNH 211351, 5: 12.2–18.3 mm SL, collected with holotype; AMS I.17367-019, 63: 11.7–18.9 mm SL, collected with holotype; AMS I.20271-027, 3: 14.4–15.2 mm SL, Norfolk Island, Bumbora Beach, 29°04'S 167°56'E, tidepools containing algae, rock, sand and small amount of coral, rotenone, D.F. Hoese & H.K. Larson, 22 September 1975; AMS I.27137-011, 6: 12.9–13.9 mm SL, Middleton Reef, 29°27.5'S 159°04.2'E, lagoon patch reef, 2.5 m, rotenone, A.C. Gill *et al.*, 5 December 1987; AMS I.27156-043, 2: 15.0–19.5 mm SL, Elizabeth Reef, 29°56.5'S 159°01.87'E, lagoon patch reef, 2–2.5 m, rotenone, A.C. Gill *et al.*, 14 December 1987; ANSP 178731, 5: 12.8–17.9 mm SL, collected with holotype; BMNH 2003.1.22.2–6, 5: 14.6–18.1 mm SL, collected with holotype; BPBM 14951, 2: 15.6–16.5 mm SL, Lord Howe Island, southern lagoon, south of Salmon Beach, coral and sand, 2 m, rotenone, D.F. Hoese, 9 February 1973; BPBM 17572, 6: 9.5–16.8 mm SL, Lord Howe Island, southeast end of Middle Beach, rocky shore, 0–3 m, rotenone, D.F. Hoese *et al.*, 11–15 February 1973; CAS 217049, 5: 12.4–19.1 mm SL, collected with holotype; USNM 228319, 20.5 mm SL, Lord Howe Island, Sylph Hole, 2–4 m, Australian Museum party, 5 February 1973; USNM 228320, 3: 8.5–18.7 mm SL, Lord Howe Island, King's Beach, 31°32'S 159°04'E, 2 m, quinaldine, D.F. Hoese, 6 February 1973; USNM 228321, 11: 12.0–18.9 mm SL, Lord Howe Island, south side of north passage, 31°32'S 159°04'E, lagoon reef, 2 m, derris dust, D.F. Hoese & G.R. Allen, 17 February 1973; USNM 228322, 14.0 mm SL, Lord Howe Island, south part of lagoon, 31°32'S 159°04'E, rock and algae, 3–6 m, derris dust, D.F. Hoese *et al.*, 7 February 1973; USNM 228323, 1: 17.9 mm SL, collected with USNM 228321; USNM 324929, 3: 11.3–15.9 mm SL, New Caledonia, Noumea, Pointe Cluxel, 22°18'30"S 166°27'24"E, shallow patch reef with rubble at base, 0.5–2 m, J.T. Williams & G. Mou Tham, 7 November 1991.

Diagnosis. The following combination of characters distinguishes *E. hoesei* from congeners: dorsal-fin rays usually VI + I,9; anal-fin rays usually I,8; at least some pectoral-fin rays branched; cephalic sensory-pore system pattern 2; base of pectoral fin with two diffuse to prominent dark spots; fifth segmented pelvic-fin ray present, usually about 1/10 length of fourth ray; and 6 subcutaneous bars/spots on lower postanal trunk.

Description. Dorsal-fin rays VI + I,8(4), VI + I,9(42); anal-fin rays I,7(4), I,8(43); pectoral-fin rays 16(17), 17(30); pectoral-fin rays 8 through 17 may be branched, 11 through 15 always branched; pelvic-fin rays I,4 plus rudiment (7), I,4 1/10(40); branches on fourth segmented pelvic-fin ray 7–15, averaging 10.6; segments between consecutive branches of fourth segmented pelvic-fin ray 0–3, averaging 1.2; pelvic-fin membrane reduced; branched caudal-fin rays 12(4), 13(5), 14(9); segmented caudal-fin rays 17(43); lateral scale rows 23(1), 24(16), 25(23), 26(2); transverse scale rows 6(30), 7(9); breast scaleless; vertebrae 10(13) precaudal plus 16(13) caudal, total 26.

First two dorsal-fin spines in males may be filamentous, first longest, maximum extension to just behind end of second dorsal-fin base; females without filamentous spines. Pelvic fin usually reaches to anal fin, maximum length to about middle of anal-fin base. Cephalic sensory-pore system pattern 2; superficial neuromast (cutaneous papillae) system pattern B. Male genital papilla non-fimbriate.

Preserved coloration. Head dorsally either pale or with scattered brown speckles; head laterally with scattered brown speckles, sometimes with clusters of brown chromatophores; lips thinly margined with chromatophores; pectoral-fin base with two diffuse or distinct dark spots, occasionally with spots merging to form single spot, often with additional dusky pigmentation above and below spots (which forms additional spot in occasional specimens); dorsal trunk midline unpigmented; trunk with dark crescent-shaped marks at scale pockets, usually darker ventrally; belly with 2–3 broad indistinct subcutaneous dusky patches; 6 subcutaneous bars/spots on lower postanal trunk, although last one or two bars may be indistinct in small specimens; subcutaneous bars on upper postanal trunk obscure, although 5 indistinct dusky bars may be present near midside, last through caudal spot; large round to oval or

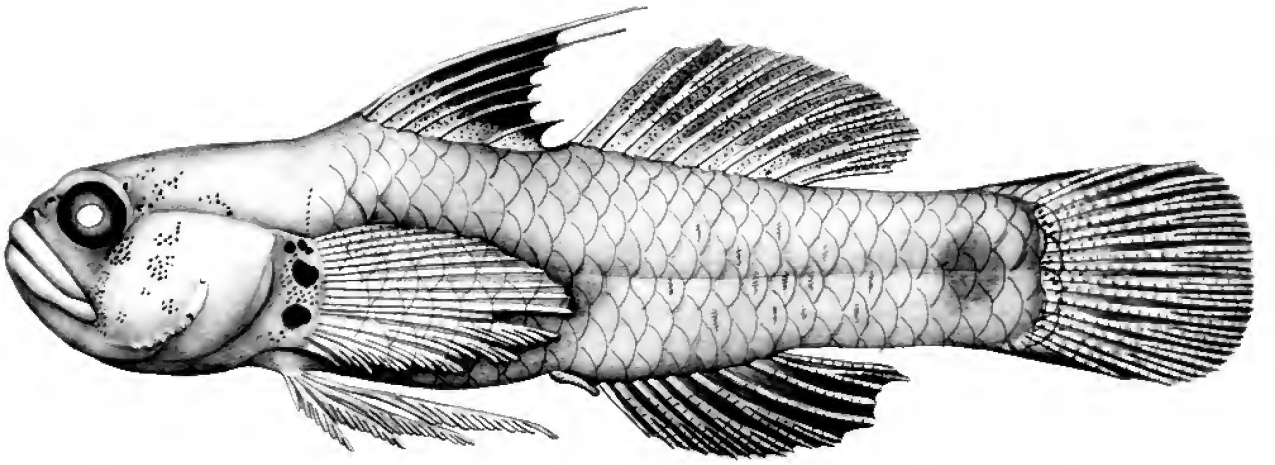

Fig. 1. *Eviota hoesei*, AMS I.17367-004, 19.7 mm SL, male, holotype, Lord Howe Island. (Drawn by J.R. Schroeder.)

rectangular dark spot on mid-caudal peduncle, all or mostly subcutaneous; first dorsal fin uniformly moderate to dark dusky, sometimes abruptly paler on base; second dorsal fin light to moderate dusky; anal fin similar to first dorsal, sometimes darker; caudal fin light to dark dusky or pale, with or without alternating dark and light spots on rays, usually paler basally; pectoral and pelvic fins pale.

Live coloration. Not recorded in detail. Allen *et al.* (1976) noted, however, that *E. hoesei* specimens collected from shallow water were green, whereas those from deeper water (below about 18 m) were red.

Etymology. The specific epithet is for our friend and colleague Douglass F. Hoese, in recognition of his important contributions to the systematics of gobioid fishes.

Comparisons. *Eviota hoesei* is a member of Lachner & Karnella's (1980) Group II species-group, which is diagnosed by the following: cephalic sensory-pore system pattern 2 (NA, AITO, PITO, SOT, AOT and POP pores present, IT pore absent); vertebrae usually 26; some pectoral-fin rays branched; pelvic-fin membranes joining first four segmented rays reduced; and fifth segmented pelvic-fin ray absent or very short. Eleven other species were assigned to Group II by Lachner & Karnella (Lachner & Karnella, 1980; Jewett & Lachner, 1983): *E. afelei* Jordan & Seale (1906), *E. bimaculata* Lachner & Karnella (1980), *E. indica* Lachner & Karnella (1980), *E. japonica* Jewett & Lachner (1983), *E. latifasciata* Jewett & Lachner (1983), *E. prasina* (Klunzinger, 1871), *P. punctulata* Jewett & Lachner (1983), *E. queenslandica* Whitley (1932), *E. saipanensis* Fowler (1945), *E. variola* Lachner & Karnella (1980), and *E. zonura* Jordan & Seale (1906). *Eviota hoesei* differs from these species in the following: fifth segmented pelvic-fin ray usually 1/10 length of fourth segmented ray (usually rudimentary or absent in *E. latifasciata, E. prasina, E. saipanensis, E. variola* and *E. zonura*); second dorsal-fin rays modally I,9 (modally I,8 in *E. indica* and *E. latifasciata*, and modally I,10 in *E. variola*); anal-fin rays modally I,8 (modally I,9 in *E. variola*); pectoral-fin rays usually 17 (with strong modes of 15 in *E. indica*, and 16 in *E. japonica, E. punctulata* and *E. zonura*); first two dorsal-fin spines filamentous in males (none filamentous in *E. indica* and *E. latifasciata*; first spine rarely filamentous in *E. punctulata*); male genital papilla non-fimbriate (fimbriate in *E. prasina, E. variola* and *E. zonura*, and cup-shaped in *E. saipanensis*); two diffuse to prominent dark spots on the pectoral-fin base (two prominent spots otherwise present only in *E. japonica* and *E. queenslandica*, although weak spots may be present in *E. prasina, E. variola* and *E. zonura*); no prominent dark spots on the occipital region (dark spots present in *E. bimaculata, E. japonica, E. prasina, E. punctulata, E. queenslandica* and *E. variola*); first dorsal fin either uniformly dusky, or dusky with pale base (mostly pale in *E. indica* and *E. latifasciata*; at least first spine usually with dark spots in *E. punctulata, E. queenslandica,*

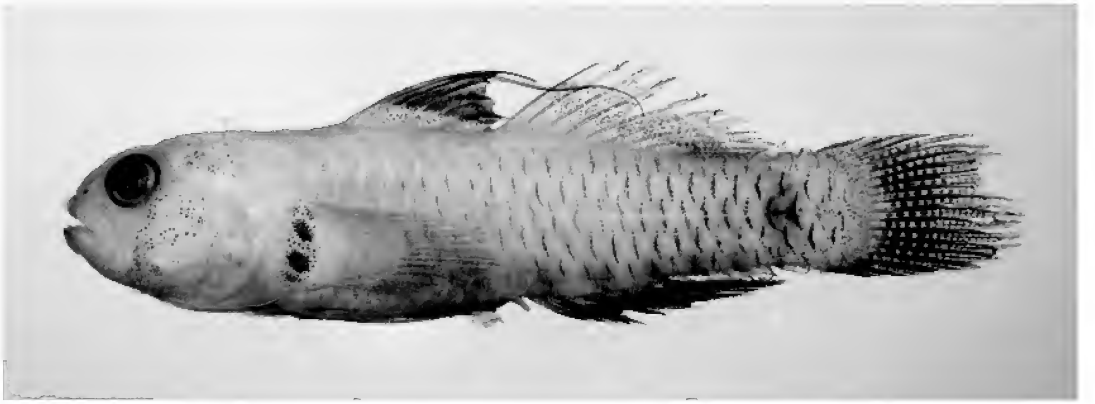

Fig. 2. *Eviota hoesei*, USNM 228323, 17.9 mm SL, male, paratype, Lord Howe Island. (Photographed by S.L. Jewett.)

E. bimaculata and *E. variola*); subcutaneous bars on upper posterior trunk obscure (4 in *E. latifasciata, E. queenslandica, E. saipanensis* and *E. zonura*, 4–5 in *E. prasina*, 5 in *E. bimaculata, E. indica, E. japonica* and *E. variola*, and 7–9 in *E. afelei*); subcutaneous bars/spots on lower posterior trunk 6 (4 in *E. saipanensis* and *E. latifasciata*, and 5 in *E. prasina, E. queenslandica, E. variola* and *E. zonura*); and dark spots along dorsal mid-line absent (well developed in *E. japonica, E. prasina, E. queenslandica* and *E. variola*).

Remarks. *Eviota hoesei* is known only from New Caledonia, the Norfolk Ridge (Norfolk Island) and Lord Howe Rise (Lord Howe Island and Middleton and Elizabeth Reefs). It has been collected from tidepools and rock and coral reefs in lagoons and reef slopes at depths ranging from 0.5 to 25 m. Gill & Reader (1992) noted that it was very common in the lagoon at Middleton and Elizabeth Reefs, and common on the reef slope at Elizabeth Reef. They further noted that it was the most abundant gobiid species at the reefs. *Eviota prasina* was also recorded as abundant at Elizabeth and Middleton Reefs and at Lord Howe Island (recorded by Allen *et al.*, 1976, as *E. viridis* Waite, 1904, a junior synonym), but was found among coral rubble in reef-crest areas.

Eviota readerae n.sp.

Figs. 3, 4

Eviota n.sp. B.—Gill & Reader, 1992: 222 (Elizabeth and Middleton Reefs).

Type material. HOLOTYPE: AMS I.27141-018, 17.9 mm SL, Middleton Reef, tidal pools on exposed reef flat near wreck of *Fuku Maru*, 29°28.8'S 159°07.5'E, rotenone, A.C. Gill & S.E. Reader, 7 December 1987. PARATYPES: AMS I.27134-038, 3: 7.8–15.3 mm SL, Middleton Reef, 29°27.2'S 159°06.8'E, north face of outer reef slope, coral bommie, 6–9 m, rotenone, A.C. Gill *et al.*, 4 December 1987; AMS I.27138-056, 3: 14.4–15.9 mm SL, Middleton Reef, mid back lagoon, 29°27.8'S 159°05'E, patch reef, 4–9 m, rotenone, A.C. Gill *et al.*, 5 December 1987; AMS I.27148-031, 4: 9.6–17.5 mm SL, Elizabeth Reef, outer east slope, 29°57.2'S 159°01.2'E, 10 m, rotenone, A.C. Gill *et al.*, 10 December 1987; AMS I.27149-034, 1: 14.5 mm SL, Elizabeth Reef, northeast outer slope, 29°54.8'S 159°02.8'E, 8–10 m, rotenone, A.C. Gill *et al.*, 10 December 1987; AMS I.27149-040, 3: 9.5–15.9 mm SL, collected with AMS I.27149-034; AMS I.27296-001, 1: 10.5 mm SL, Middleton Reef, outer reef edge near wreck of *Runic*, 29°27.4'S 159°03.7'E, 30–40 m, airlift substrate sampler, J.K. Lowry & R.T. Springthorpe, 5 December 1987; BMNH 2003.1.22.7–8, 2: 9.9–14.9 mm SL, collected with AMS I.27134-038; USNM 372388, 2: 14.0–14.6 mm SL, collected with AMS I.27134-038.

Diagnosis. The following combination of characters distinguishes *Eviota readerae* from congeners: dorsal-fin rays VI + I,9; anal-fin rays I,8; at least some pectoral-fin rays branched; fifth segmented pelvic-fin ray lacking; cephalic sensory-pore system pattern 1; male genital papilla non-fimbriate; 12–13 dark bars or saddles on trunk from origin of spinous dorsal fin to mid peduncular spot, not extending below midline (except in small juveniles); and pectoral-fin base with prominent circular dark spot dorsally (only occasionally with additional small diffuse spot ventrally).

Description. Dorsal-fin rays VI + I,9(20); anal-fin rays I,8(20); pectoral-fin rays 16(1), 17(16), 18(3); pectoral-fin rays 9 through 17 may be branched, 11 through 15 always branched; pelvic-fin rays I,4 (20); branches on fourth segmented pelvic-fin ray 7–12, averaging 8.9; segments between consecutive branches of fourth segmented pelvic-fin ray 0–3, averaging 1.1; pelvic-fin membrane reduced; branched caudal-fin rays 13(6), 14(4), 15(1); segmented caudal-fin rays 17(20); lateral scale rows 23(1), 24(2), 25(5), 26(3); transverse scale rows 6(4), 7(8); breast scaleless; vertebrae 10(16) precaudal plus 16(16) caudal, total 26.

Spinous dorsal fin not elongate in either sex. Pelvic fin usually reaches to anus, maximum length to about base of second segmented anal-fin ray. Cephalic sensory-pore system pattern 1; superficial neuromast (cutaneous papillae) system pattern A. Male genital papilla non-fimbriate.

Preserved coloration. Four weak saddles to dark bars present dorsally on head and on nape in front of spinous dorsal fin; anteriormost two bars ending ventrally in prominent dark spots; head otherwise generally pale or with clusters of brown chromatophores, usually around posterior margin of eye, on lower cheek, just behind mid-posterior edge of eye, on anterior part of opercle, on subopercle, on branchiostegal membrane (adjacent to subopercle cluster), and sometimes on chin and lower lip; pectoral-fin base with prominent circular dark spot dorsally, which may encroach posteriorly on to bases of upper few pectoral-fin rays; small diffuse second spot or cluster of melanophores occasionally on ventral part of pectoral-fin base; 12–13 prominent dark bars present on trunk from origin of spinous dorsal fin to midpeduncular spot; bars generally not extending below midline, often reduced to series of short dorsal saddles, extending below midline only in small juveniles; five subcutaneous spots or short bars on lower postanal trunk, though some or all may be weakly developed or lacking in some specimens; last subcutaneous bar continuous with

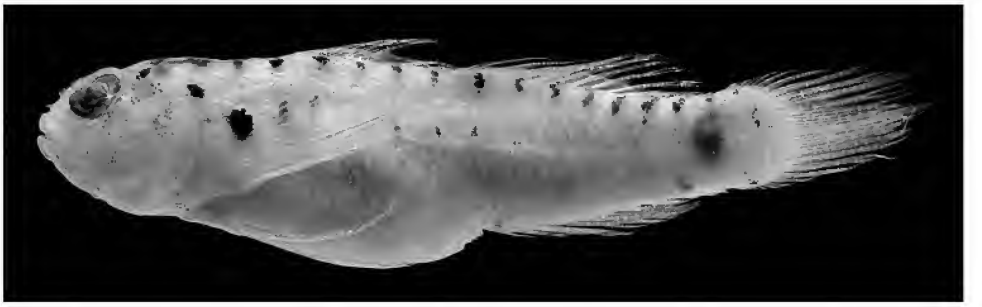

Fig. 3. *Eviota readerae*, AMS I.27141-018, 17.9 mm SL, female, holotype, Middleton Reef. (Photographed by H. Taylor.)

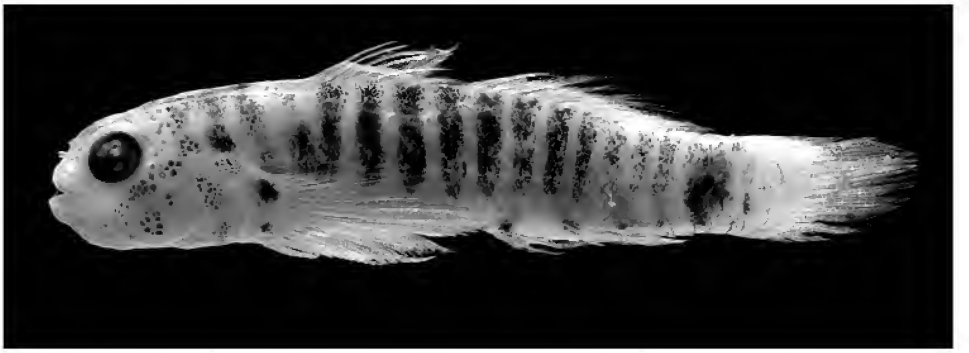

Fig. 4. *Eviota readerae*, AMS I.27148-031, 17.4 mm SL, male, paratype, Elizabeth Reef. (Photographed by H. Taylor.)

prominent caudal peduncle spot, which is all or mostly subcutaneous; scale margins may be lightly edged with melanophores, but scale pockets not outlined; trunk bars and subcutaneous spots sometimes extending slightly on to dorsal and anal fins; spinous dorsal fin immaculate pale, or pale with 1–2 broad, diffuse dusky bars; second-dorsal and anal fins varying from pale to dusky; caudal, pectoral and pelvic fins may have rays bordered with melanophores, but otherwise pale.

Live coloration. Not recorded.

Etymology. The specific epithet is for Sally E. Reader, who assisted the first author with the collection of most of the type specimens, and kindly arranged the loan of specimens for this study.

Comparisons. *Eviota readerae* is a member of Lachner & Karnella's (1980) Group I species-group, which is diagnosed by the following: total vertebrae usually 26; some pectoral-fin rays branched; male genital papilla non-fimbriate; and cephalic sensory-pore system 1 (NA, AITO, PITO, SOT, AOT, POP and IT pores present). It belongs to a complex of species within this group that Karnella & Lachner (1981) termed the *Eviota epiphanes* complex. *Eviota readerae* and the other members of this complex (*E. disrupta* Karnella & Lachner, 1981, *E. epiphanes* Jenkins, 1903, *E. fasciola* Karnella & Lachner, 1981, and *E. irrasa* Karnella & Lachner, 1981) differ from other Group I species in sharing the following combination of characters: dorsal-fin rays usually VI + I,9; anal-fin rays usually I,8; no elongation of spinous dorsal-fin rays in either sex; pelvic-fin rays I,4; pelvic-fin membranes joining segmented rays reduced; segments between consecutive branches of fourth pelvic-fin ray usually 1; and five subcutaneous spots on lower postanal trunk. The species are also similar in general coloration: head and nape with bars dorsally; at least short bars or saddles along the dorsal midline of the trunk; head with scattered large chromatophores ventrally and laterally, often arranged in clusters or large spots; caudal peduncle with well-developed subcutaneous spot, which is integrated with a weak to strong subcutaneous bar; and first dorsal fin with dark irregularly mottled or barred pattern. The five species are differentiated on the basis of coloration characters (see Karnella & Lachner, 1981: table 1). The following characters distinguish *E. readerae*: pectoral-fin base with prominent circular dark spot dorsally (versus weak spot dorsally in *E. epiphanes*, well-developed kidney-shaped or semicircular mark over entire base in *E. fasciola*, a dorsal and a ventral well-developed discrete circular spot in *E. disrupta*, and a dorsal and a ventral well-developed indiscrete oval or circular spot in *E. irrasa*); pectoral spot equal to or darker than other body pigmentation (versus equal to or less than in *E. epiphanes*, equal to in *E. irrasa*, and darker than in *E. fasciola* and *E. disrupta*); trunk bars not extending below midline (reduced to saddles in *E. epiphanes*, and extending to lower body in *E. fasciola* and *E. disrupta*); trunk bars usually discrete and uniform (versus interrupted anteriorly in *E. disrupta*, and not discrete in *E. irrasa*); branchiostegal mark present (versus absent in *E. epiphanes*); no scale pocket pigmentation (versus weakly developed in *E. irrasa*, and well developed in *E. epiphanes*); and pale area present on posterior opercle and anterior pectoral-fin base (absent in *E. epiphanes*).

Remarks. *Eviota readerae* is known only from Middleton and Elizabeth Reefs on the Lord Howe Rise, Tasman Sea. It has been collected from tidal pools, lagoon patch reefs and reef slopes at depths ranging from about 0.3 to at least 30 m.

Identity of *Eviota corneliae* Fricke, 1998

Fricke (1998) described *E. corneliae* on the basis of two specimens from Maré Island, Loyalty Islands. He assigned the species to the *E. epiphanes* complex on the basis of it having vertical trunk bars. Several salient details are missing from Fricke's description, particularly details of head pore structure. We therefore borrowed the holotype (SMNS 19870) in order to make comparisons with *E. readerae* and other *E. epiphanes* complex species. Our examination of the holotype revealed that it is not a species of *Eviota*, differing in various details: head pores absent (versus usually present in *Eviota*; absent only in one undescribed species); subcutaneous spots or bars absent (versus almost always present); and gill opening wide (versus narrow), extending

Fig. 5. *Trimmatom eviotops*, SMNS 19870, 14.0 mm SL, holotype of *Eviota corneliae* Fricke, Maré Island, Loyalty Islands. (Photographed by H. Taylor.)

to vertical through rear edge of eye. We also noticed several discrepancies with the original description: there are I,5 not I,4 pelvic-fin rays (the inner ray is small and unbranched); whereas Fricke recorded the lower seven pectoral-fin rays as branched, we could find no evidence of branched rays in the fin (although the ray tips of most rays are broken, some of the lower rays are undamaged and not branched); Fricke recorded a spine and eight rays in the anal fin, but there are 10 rays, the anteriormost of which is bilaterally paired, thus not a true spine; and the positions of some of the trunk bars are incorrectly depicted (compare Fricke's fig. 1 with Fig. 5). Also, although Fricke correctly gave the length of the holotype as 14.0 mm SL, the scale bar in his figure suggests that the specimen is about 35 mm SL; the scale bar is obviously intended to indicate 2 mm, not 5 mm as incorrectly indicated in the figure caption.

The *E. corneliae* holotype keys to *Trimmatom* Winterbottom & Emery (1981) using Larson & Murdy's (2001) key to western central Pacific gobiid genera. We therefore contacted R. Winterbottom, current expert on *Trimmatom* and related genera, for assistance. He confirmed the generic assignment, although noting that the recognition of the genus as distinct from *Trimma* Jordan & Seale is tentative; his phylogenetic studies suggest that *Trimmatom* is nested within *Trimma*, and that the recognition of *Trimmatom* may therefore render *Trimma* paraphyletic (see also Winterbottom, 1990). He further identified the holotype as *Trimmatom eviotops* (Schultz, 1943). *Eviota corneliae* Fricke (1998) is therefore a junior subjective synonym of *Trimma eviotops* Schultz (1943).

ACKNOWLEDGMENTS. We are grateful to the following for the loan of specimens: R. Fricke, D.F. Hoese, H.K. Larson, M. McGrouther, J.E. Randall, S.E. Reader and A. Suzumoto. Specimens of the new species were collected by the first author and associates on an Australian Museum expedition to Middleton and Elizabeth Reefs in 1987; he extends his thanks to other expedition participants, particularly S.E. Reader, M. Cordell and D. Leadbitter for their assistance in making rotenone stations. We are grateful to D.F. Hoese and R. Winterbottom for helpful discussions, in particular to R. Winterbottom for his input on the identity of *E. corneliae* and for review of the manuscript. We thank O.A. Crimmen for radiographs, H. Taylor for the photographs of *E. readerae* and the holotype of *E. corneliae*, and J.R. Schroeder for his drawing of the holotype of *E. hoesei*. The second author thanks the late Ernest A. Lachner who, in about 1971, lured her into the study of *Eviota* with the promise that it was a tidy little group comprising just a few undescribed species, for his inspiration and collaboration on earlier papers.

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Three New Australian Species of the Fish Genus *Xenisthmus* (Gobioidei: Xenisthmidae)

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ABSTRACT. *Xenisthmus chi* n.sp., described from two specimens from Rowley Shoals, Timor Sea, has in combination: second dorsal-fin rays I,12; anal-fin rays I,11; predorsal area with narrow median wedge of scales extending forward almost to pore D; posterior naris without flap; and head and body pale with brown reticulate mottling, forming about 11 X-shaped markings along sides between pectoral- and caudal-fin bases. *Xenisthmus eirospilus* n.sp., described from 15 specimens from throughout the southwest Pacific (type locality Elizabeth Reef, Tasman Sea), has in combination: second dorsal-fin rays I,12–13, usually I,12; anal-fin rays I,11–12, usually I,11; vertebrae 10 + 17; tongue indented; posterior naris with well-developed flap; upper sides of body with 12 large closely spaced spots, which usually do not extend to dorsal edge of body; and predorsal scaled to vertical through posterior edge of preopercle. *Xenisthmus semicinctus* n.sp., described from two specimens from Rowley Shoals, Timor Sea, has in combination: second dorsal-fin rays I,12; anal-fin rays I,11; vertebrae 10 + 17; tongue indented; posterior naris with well-developed flap; upper sides of body with 12 large, closely spaced spots, each connecting dorsally to, or almost to, mid-line by short, dark bar; and predorsal area with narrow median wedge of scales extending forward almost to pore D.

GILL, ANTHONY C., & DOUGLASS F. HOESE, 2004. Three new Australian species of the fish genus *Xenisthmus* (Gobioidei: Xenisthmidae). *Records of the Australian Museum* 56(2): 241–246.

Xenisthmus Snyder, 1908 (*Gignimentum* Whitley, 1933, *Luzoneleotris* Herre, 1938, *Platycephalops* Smith, 1957, and *Kraemericus* Schultz, 1966, are synonyms) is one of five genera that constitute the Indo-Pacific family Xenisthmidae, a well-corroborated, monophyletic group within the perciform suborder Gobioidei (Springer, 1983, 1988; Gill & Hoese, 1993). Species of the genus are distinguished from other xenisthmids by a single synapomorphy (third branchiostegal ray with an expanded proximal head), and in having the following combination of symplesiomorphies: first dorsal-fin with six spines; body scaled; and palatine teeth absent (Gill & Hoese, 1993). They are sand-diving fishes generally associated with sand patches adjacent to reef or rubble, particularly in surge areas.

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Xenisthmus includes only eight nominal species: *Eleotris polyzonatus* Klunzinger (1871), *Gignimentum penicillum* Whitley (1933), *Hetereleotris clara* Jordan & Seale (1906), *Kraemericus chapmani* Schultz (1966), *Luzoneleotris nasugbua* Herre (1938), *Xenisthmus africanus* Smith (1958), *X. balius* Gill & Randall (1994), and *X. proriger* Snyder (1908). Our ongoing studies indicate, however, that there are at least 10 additional undescribed species in the genus. We herein describe three such species, all of which have been collected from Australian waters.

Materials and methods

Measurements were made with dial calipers, recorded to the nearest 0.1 mm. All measurements to the snout tip were made to the mid-anterior tip of the upper lip. Standard length (SL) is the distance from the snout tip to the middle of the caudal-fin base, and is the body length used herein unless noted otherwise. Predorsal, preanal and prepelvic lengths are distances from the snout tip to the base of the anteriormost spine of the relevant fin. Head length is the distance from the snout tip to the dorsal edge of the gill opening. Head width is the broadest measurement between the posterior edges of the preopercles. Body width is the distance between the pectoral-fin bases. Snout length is over the shortest distance from the snout tip to the orbital rim. Orbit diameter is the horizontal width of the eyeball. Bony interorbital width is the least measurement. "Snout tip to retroarticular tip" is the distance from the snout tip to the posteriormost tip of the retroarticular bone. Caudal-peduncle length is the distance from the base of the posteriormost anal-fin ray to the ventral edge of the caudal peduncle at the vertical through the posterior edge of the lower hypural plate. Caudal-peduncle depth is the oblique distance between the bases of the posteriormost anal- and dorsal-fin rays. Pectoral-fin base depth is the vertical depth of the fleshy lobe. Pectoral-fin length is the length of the longest ray. Caudal-fin length is the length of the ventralmost ray on the upper hypural plate. Other measurements are self explanatory.

The last ray in the anal and second-dorsal fins is divided at its base and was counted as a single ray. "Scales in lateral series" was counted from the upper edge of the pectoral-fin base along the mid-side of the body to the posterior edge of the hypural plate. "Scales in forward transverse series" is the number of scales in the transverse series counted anterodorsally from the anal-fin origin. "Scales in backward transverse series" is the number of scales in the transverse series counted posterodorsally from the anal-fin origin. The pattern of interdigitation of first-dorsal-fin proximal pterygiophores between neural spines is given as a dorsal-fin pterygiophore formula following Birdsong *et al.* (1988). Gill-raker counts include all elements on the outer face of the first arch; the angle raker is included in the lower-limb (second) count. Letter codes for cephalic lateralis pores follow Akihito (1984; see also Gill & Randall, 1994: fig. 2). Specimens were temporarily stained with Cyanine Blue 5R to facilitate examination of small structures (Saruwatari *et al.*, 1997). Osteological details were determined from radiographs. Institutional codes follow Leviton *et al.* (1985).

Counts and morphometric values are presented first for the holotype, followed, where different, by value ranges or frequency distributions for paratypes. Frequency distributions are presented in the form "x fy", where "x" is the count and "f" indicates that the following value, "y", is its frequency. Where counts were recorded bilaterally from the holotype, both counts are given and separated from each other by a slash; the first count presented is the left count.

Xenisthmus chi n.sp.

Fig. 1

Xenisthmus sp. 2.—Allen & Russell, 1986: 100 (Rowley Shoals).

Type material. HOLOTYPE: WAM P.28030-033, 20.6 mm, male, Timor Sea, Rowley Shoals, Clerke Reef, 2 km south of Bedwell Island, 17°18'S 119°20'E, rotenone, G.R. Allen & R.C. Steene, 11 August 1983. PARATYPE: WAM P.28030-041, 22.0 mm, female, collected with holotype.

Diagnosis. A species of *Xenisthmus* with the following combination of characters: second dorsal-fin rays I,12; anal-fin rays I,11; predorsal area broadly scaled to just behind vertical through posterior edge of preopercle, with narrow median wedge of scales extending further forward almost to pore D; posterior naris without flap on anterior rim; and head and body pale with brown reticulate mottling, forming about 11 X-shaped markings along sides between pectoral- and caudal-fin bases.

Description. Dorsal-fin rays VI + I,12, all segmented rays branched; first dorsal-fin pterygiophore formula 3–13110; anal-fin rays I,11, all segmented rays branched; pectoral-fin rays 17/17, upper 1 (2) and lower 1 (2) ray(s) unbranched; pelvic-fin rays I,5, inner ray unbranched; segmented caudal-fin rays 9 + 8; branched caudal-fin rays 7 + 7; upper

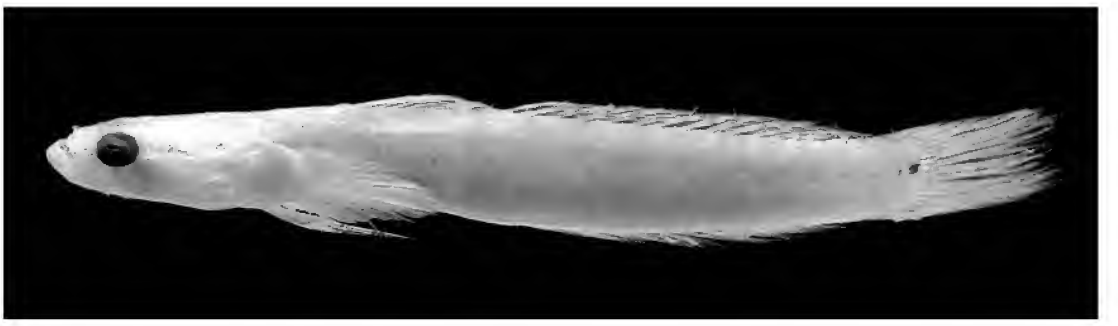

Fig. 1. *Xenisthmus chi*, holotype, WAM P.28030-033, 20.6 mm, male, Clerke Reef, Rowley Shoals, Timor Sea, Australia. (Photo by H. Taylor.)

unsegmented caudal-fin rays 7 (8); lower unsegmented caudal-fin rays 7 (8); total caudal-fin rays 31 (33); scales in lateral series 57/55 (52 f1; 54 f1); scales in forward transverse series 20/19 (17 f1; 18 f1); scales in backward transverse series 18/18 (16 f1; 19 f1); circumpeduncular scales 27 (26); predorsal scales 21 (18); cheek scales 4; gill-rakers 3 + 9 (2 + 9); pseudobranch filaments 4; vertebrae 10 + 16; epurals 2.

As thousandths of SL: head length 248 (241); predorsal length 340 (332); prepelvic length 238 (245); preanal length 515 (555); first dorsal-fin origin to second dorsal-fin origin 184 (182); second dorsal-fin base length 340 (355); anal-fin base length 306 (291); pectoral-fin base depth 73 (68); first dorsal-fin origin to pelvic-fin origin 170 (173); second dorsal-fin origin to anal-fin origin 141 (132); snout length 39 (45); orbit diameter 58 (55); head width 131 (145); body width 107 (109); bony interorbital width 15 (18); snout tip to retroarticular tip 97 (106); caudal-peduncle length 170 (168); caudal-peduncle depth 112 (114); length of first spine of first dorsal fin 92 (82); length of third spine of first dorsal fin 102 (100); length of sixth spine of first dorsal fin 63 (68); length of spine of second dorsal fin 87 (77); length of first segmented ray of second dorsal fin 117 (100); length of last segmented ray of second dorsal fin 121 (123); anal-fin spine length 73 (64); length of first segmented anal-fin ray 83 (95); length of last segmented anal-fin ray 131 (127); pectoral-fin length 209 (227); fourth segmented pelvic-fin ray length 189 (186); caudal-fin length 204 (209).

Body covered with small scales; scales cycloid on anterior and lower abdomen (in front of vertical through middle of abdomen), and narrowly along upper and ventral edges of body (adjacent to bases of dorsal and anal fins), remainder of body and caudal peduncle with ctenoid scales; ventral contour of abdomen fully scaled, except for narrow area beneath branchiostegal membranes; predorsal area broadly scaled to just behind vertical through posterior edge of preopercle, with narrow median wedge of scales extending farther forward almost to pore D; cheeks and upper part of operculum scaled; scales present on pectoral-fin base; narrow band of mostly ctenoid scales on fleshy portion of caudal-fin base; no scales on dorsal- or anal-fin bases.

Head pores A'BC D(S)EFHIJK' M'NOPQ'; lower lip fleshy and protruding, with uninterrupted, free ventral margin; anterior naris in short tube; posterior naris with raised rim, without prominent membranous flap anteriorly; tongue indented anteriorly; gill opening extending anteriorly to about midway between verticals through posterior edge of preopercle and posterior edge of eye.

Upper jaw with 2 or 3 (anteriorly) or 2 (posteriorly) rows of small, conical teeth, outer-row teeth largest and slightly curved; lower jaw with 3 (anteriorly) or 2 (posteriorly) rows of small, conical teeth, outer-row teeth largest and slightly curved; vomer, palatines and tongue edentate.

Preserved coloration. Head and body beige to pale brown with brown reticulate mottling (obvious when first examined in 1992, but now considerably faded); two short brown bars extending from eye, one from below mid-ventral part of orbital rim to just above posterior edge of maxilla, and one from posteroventral part of orbital rim to middle of cheek; upper part of pectoral-fin base with irregular dusky brown spot; second brown spot on middle part of pectoral-fin base (mostly concealed by gill membranes); brown mottling on body aligning to form about 11 X-shaped markings along sides between pectoral- and caudal-fin bases; first dorsal fin hyaline with irregular dusky brown spots basally, and prominent dark grey-brown spot posteriorly on distal part of fin behind sixth spine; second dorsal fin hyaline with two (anteriorly) or three (posteriorly) series of small brown spots arranged along length of each fin ray; caudal fin hyaline to beige with short dusky brown bar lining hypural edge near middle few caudal-fin rays; immediately behind bar, a dark grey-brown spot, overlying bases of lower three caudal-fin rays on upper hypural plate; remainder of caudal fin with three or four narrow wavy bars, best developed on upper part of fin; anal fin hyaline to beige; pectoral fins hyaline, with small, dark brown spot basally on upper third of fin; pelvic fins hyaline.

Live coloration. Not known.

Comparisons. *Xenisthmus chi* closely resembles *X. balius* in general coloration pattern and in lacking a flap on the posterior naris. It differs from that species in having fewer segmented dorsal- and anal-fin rays (12 and 11, respectively, versus 13 and 12–13, usually 12, in *X. balius*); a different first dorsal-fin pterygiophore pattern (3–13110 versus 3–22110); fewer scales in lateral series (52–57 versus 60–70); more extensive coverage of ctenoid scales on the body (body behind middle of abdomen with ctenoid scales versus at most only a few scattered ones on caudal peduncle); cheek and operculum scaled (versus naked); and predorsal scales with median series extending to near pore D (versus predorsal area broadly scaled to about vertical through posterior edge of preopercle).

Remarks. The specific epithet is a noun in apposition derived from the Greek letter (chi), and alludes to the X-shaped markings on the body.

Xenisthmus eirospilus n.sp.

Fig. 2

Xenisthmus n.sp.—Gill & Reader, 1992: 224 (Elizabeth and Middleton Reefs, Tasman Sea).

Type material. HOLOTYPE: AMS I.27149-041, 19.3 mm, female, Australia, Tasman Sea, NE slope of Elizabeth Reef, 29°54'S 159°02'48"E, 5–10 m, sand around base of coral patch reef, rotenone, A.C. Gill *et al.*, 10 December 1987. PARATYPES: AMS I.27134-034, 2: 16.0 mm, male, 21.2 mm, ♀, Australia, Tasman Sea, Middleton Reef, 29°27'12"S 159°06'48"E, 6–9 m, reef front, rotenone, A.C. Gill *et al.*, 4 December 1987; AMS I.33739-081, 2: 12.5–15.2 mm, juveniles, Australia, Coral Sea, NE side of Ashmore Reef, front reef slope, 6–9 m, FNQII party, 25 January 1993; BMNH 2003.1.22.9, 1: 14.1 mm, juvenile, collected with AMS I.33739-081; BPBM 39134, 12.0 mm, juvenile, American Samoa, north shore of Tutuila, west side of Tapisi Point, rocky shore with surge, vertical dropoff to 6 m, rotenone, J.E. Randall *et al.*, 9 May 1974; ROM 73524, 1: 14.5 mm, juvenile, 1: 19.5 mm, ♀, Fiji, Great Astrolabe Reef, 3.7 km east of Yanu-Yanu-i-Sau I., area on reef top around prominent "rock" just south of south side of Herald Pass, R. Winterbottom *et al.*, 5 April 1983; USNM 283132, 17.7 mm, juvenile, Fiji, south coast of Rotuma, east of Sumi,

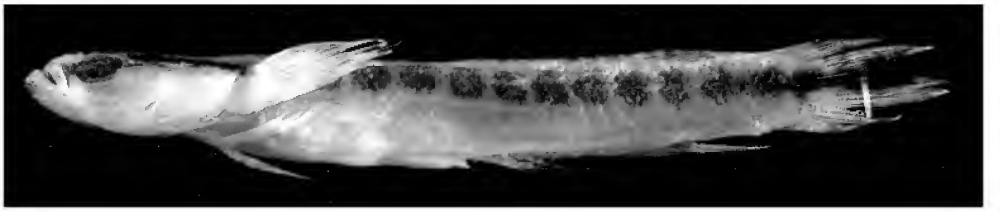

Fig. 2. *Xenisthmus eirospilus*, holotype, AMS I.27149-041, 19.3 mm, female, Elizabeth Reef, Tasman Sea, Australia. (Photo by P. Crabb.)

c. 12°30'S 177°05'E, 0–9 m, V.G. Springer *et al.*, 9 May 1986; USNM 338561, 4: 16.8–21.0 mm, ♀♀, Tonga, Vava'u Group, Hunga Island, eastern shore at small undercut cave in shore, 18°40'55"S 174°06'05"W, surge zone at rocky undercut, coral and rock bottom along surge channels, 0–5 m, J.T. Williams *et al.*, 25 October 1995; USNM 352587, 1: 18.2 mm, male, Solomon Islands, Santa Cruz Islands, Reef Islands, Lomlom Island, steep vertical wall at Nialo Point on east side of Forrest Passage, 10°16'S 166°18'30"E, vertical reef wall and rocky surge channels at surface, 0–35 m, rotenone and dipnets, J.T. Williams *et al.*, 18 September 1998.

Diagnosis. A species of *Xenisthmus* with the following combination of characters: second dorsal-fin rays I,12–13, usually I,12; anal-fin rays I,11–12, usually I,11; vertebrae 10 + 17; tongue indented; posterior naris with well-developed flap on anterior rim; upper sides of body with 12 large, closely spaced spots, which usually do not extend to dorsal edge of body; and predorsal area broadly scaled to about vertical through posterior edge of preopercle.

Description. Dorsal-fin rays VI + I,13 (I,12 f14); first dorsal-fin formula 3–22110; anal-fin rays I,11 (I,11 f13; I,12 f1); pectoral-fin rays 15/15 (15 f4; 16 f23; 17 f1), upper 1/1 (1–2) and lower 0/0 (0–3) rays unbranched; pelvic-fin rays I,5, inner ray unbranched; segmented caudal-fin rays 9 + 8; branched caudal-fin rays 8 + 7 (7–8 + 6–7 = 13–15); upper unsegmented caudal-fin rays 7 (5 f1; 7 f10; 8 f3); lower unsegmented caudal-fin rays 7 (5 f1; 6 f8; 7 f4; 8 f1); total caudal-fin rays 31 (27 f1; 30 f8; 31 f2; 32 f2; 33 f1); scales in lateral series 54/57 (50 f1; 51 f3; 52 f5; 53 f6; 54 f2; 55 f5; 56 f2; 57 f2; 58 f2); scales in forward transverse series 18/20 (17 f1; 18 f8; 19 f4; 20 f11; 21 f3; 22 f1); scales in backward transverse series 20/20 (16 f1; 17 f4; 18 f8; 19 f7; 20 f6; 21 f2); circumpeduncular scales 25 (24 f3; 25 f3; 26 f3; 27 f3; 28 f1); predorsal scales 17 (12 f1; 13 f4; 14 f5; 15 f3; 17 f1); cheek scales 3 (1–4); gill-rakers 2 + 8 (1–3 + 7–11 = 8–13); pseudobranch filaments 3 (3 f8; 4 f1); vertebrae 10 + 17; epurals 2.

As thousandths of SL (based on holotype and six paratypes, 15.2–21.0 mm): head length 249 (233–257); predorsal length 342 (324–355); prepelvic length 233 (224–241); preanal length 565 (531–566); first dorsal-fin origin to second dorsal-fin origin 192 (171–195); second dorsal-fin base length 332 (309–333); anal-fin base length 280 (274–303); pectoral-fin base depth 67 (62–75); first dorsal-fin origin to pelvic-fin origin 166 (152–178); second dorsal-fin origin to anal-fin origin 135 (126–143); snout length 41 (40–53); orbit diameter 62 (62–72); head width 124 (115–138); body width 109 (92–125); bony interorbital width 16 (14–20); snout tip to retroarticular tip 98 (90–105); caudal-peduncle length 171 (151–174); caudal-peduncle depth 104 (97–118); length of first spine of first dorsal fin 73 (69–95); length of third spine of first dorsal fin 88 (79–101); length of sixth spine of first dorsal fin 57 (52–71); length of spine of second dorsal fin 83 (72–101); length of first segmented ray of second dorsal fin 98 (87–107); length of last segmented ray of second dorsal fin? (broken in holotype, 87–126); anal-fin spine length 62 (57–77); length of first segmented anal-fin ray 83 (86–92); length of last segmented anal-fin ray 130 (79–131); pectoral-fin length 212 (174–217); fourth segmented pelvic-fin ray length 161 (154–185); caudal-fin length 218 (190–217).

Body covered with small scales; scales cycloid on anterior body, usually ctenoid on mid-side (more or less posterior to oblique line extending from posterior third of anal-fin base to anterior third of second dorsal-fin base) and caudal peduncle, although sometimes with mostly cycloid scales present and only few ctenoid scales on posterior body (mostly on caudal peduncle); ventral body contour fully scaled, except for narrow area beneath branchiostegal membranes; predorsal area broadly scaled to about vertical through posterior edge of preopercle; cheeks and upper part of operculum scaled; scales present on pectoral-fin base; narrow band of mostly ctenoid scales on fleshy portion of caudal-fin base; no scales on dorsal- or anal-fin bases.

Head pores A'BC D(S)EFHIJK' M'NOPQ' (head pores incompletely developed in 12.0 mm paratype); lower lip fleshy and protruding, with uninterrupted, free ventral margin; anterior naris in short tube; posterior naris with raised rim, with prominent membranous flap anteriorly; tongue indented anteriorly; gill opening extending anteriorly to about midway between verticals through posterior edge of preopercle and posterior edge of eye.

Upper jaw with 2–3 (anteriorly) or 2 (posteriorly) rows of small, conical teeth, outer-row teeth largest and slightly curved; lower jaw with 2–4 (anteriorly) or 2 (posteriorly) rows of small, conical teeth, outer-row teeth largest and slightly curved; vomer, palatines and tongue edentate.

Preserved coloration. Head and body beige to pale brown; short, narrow, dark grey-brown stripe extending from mid-anterior orbital rim to mid-side of upper lip; second dark grey-brown stripe extending from mid-posterior orbital rim to shoulder, overlapping upper part of pectoral-fin base; sides of body with 12 large (almost as large as eye diameter), dark brown to dark grey-brown spots, some of which may coalesce in some specimens (particularly final two on caudal peduncle); first spot just behind pectoral-fin base, second below first dorsal-fin origin, third below middle of first dorsal-fin base, fourth beneath and between dorsal fins, next six equally spaced beneath second dorsal-fin base, final two on caudal peduncle; posterior few spots on body and caudal peduncle sometimes connected to dorsal mid-line by short

bars, or with irregular dorsal extensions to form saddles over caudal peduncle; first dorsal fin hyaline, usually with series of dark brown to dark grey-brown spots (one per fin ray) on distal third of fin; second dorsal fin hyaline with series of dark brown to dark grey-brown spots (one per fin ray) on distal third of fin, often with additional series of dark grey-brown spots on fin-ray bases; caudal fin hyaline with short dusky brown bar lining hypural edge near middle few caudal-fin rays; behind bar, a dark grey to grey-brown spot between lower three rays on upper hypural plate and upper ray on lower hypural plate; broad dusky brown to dark brown stripe extending from caudal-fin spot on to distal part of fin, often to distal tip of fin; remainder of caudal fin with several narrow wavy bars, usually best developed on upper part of fin; anal fin hyaline, sometimes with series of dark brown to grey-brown spots (one per fin ray) along distal third of fin; pectoral and pelvic fins hyaline to beige.

Live coloration. Not recorded in detail, although field notes (by J.E. Randall) accompanying BPBM 39134 say "white with a mid-lateral row of blackish dots".

Comparisons. *Xenisthmus eirospilus* belongs to a species complex characterized by the following combination of characters: upper sides of body with a series of large dark spots; second dorsal-fin rays usually I,12; anal-fin rays usually I,11; tongue indented; posterior naris with well-developed anterior flap; and vertebrae 10 + 17. *Xenisthmus semicinctus* is the only other described species in the complex. It differs from *X. eirospilus* in the following: predorsal scales with median series extending to near pore D (versus predorsal area broadly scaled to about vertical through posterior edge of preopercle); a median spot or short bar on the upper nape, just anterior to the vertical through the pectoral-fin base (versus nape without dark markings); no dark stripe extending from the bar or spot on the caudal-fin base (versus stripe present); and dark bands extending dorsally from the body blotches to the dorsal edge of the body (versus mostly without bands extending from dark blotches, although such bands occasionally present beneath posterior part of second dorsal fin). Additional, undescribed species in this complex are known from southern Japan, the Philippines and the Caroline Islands.

Remarks. The specific epithet is a noun in apposition derived from the Greek *eiro*, to join in lines or string together, and *spilos*, spot or fleck, and alludes to the prominent pattern of closely spaced dark spots on the mid-side.

Xenisthmus semicinctus n.sp.

Fig. 3

Xenisthmus sp. 1.—Allen & Russell, 1986: 100 (Rowley Shoals).

Type material. HOLOTYPE: WAM P.28025-048, 19.4 mm, male, Timor Sea, Rowley Shoals, Clerke Reef, lagoon, 1.5 km south of Bedwell Island, 17°18'S 119°22'E, 1–2 m, rotenone, G.R. Allen & R.C. Steene, 6 August 1983. PARATYPE: WAM P.28025-068, 18.0 mm, presumptive male, collected with holotype.

Diagnosis. A species of *Xenisthmus* with the following combination of characters: second dorsal-fin rays I,12; anal-fin rays I,11; vertebrae 10 + 17; tongue indented; posterior naris with well-developed flap on anterior rim; upper sides of body with 12 large, closely spaced spots, each connecting dorsally to, or almost to, mid-line by short, brown to dark brown bar; and predorsal area broadly scaled to just behind vertical through posterior edge of preopercle, with narrow median wedge of scales extending further forward almost to pore D.

Description. Dorsal-fin rays VI + I,12, all segmented rays branched; first dorsal-fin pterygiophore formula 3–22110; anal-fin rays I,11, all segmented rays branched; pectoral-fin rays 16/16 (15 f2), upper 1/1 and lower 1/1 (0 f2) rays unbranched; pelvic-fin rays I,5, inner ray unbranched; segmented caudal-fin rays 9 + 8; branched caudal-fin rays 8 + 7; upper unsegmented caudal-fin rays 7; lower unsegmented caudal-fin rays 7 (6); total caudal-fin rays 31 (30); scales in lateral series 55/60 (58 f2); scales in forward transverse series 19/21 (19 f1; 20 f1); scales in backward transverse series 19/21 (17 f1; 19 f1); circumpeduncular scales 28 (27); predorsal scales 21 (20); cheek scales 4; gill-rakers 3 + 10 (2 + 9); pseudobranch filaments 3; vertebrae 10 + 17; epurals 2.

As thousandths of SL: head length 242 (244); predorsal length 324 (339); prepelvic length 237 (233); preanal length 485 (533); first dorsal-fin origin to second dorsal-fin origin 180 (189); second dorsal-fin base length 335 (322); anal-fin base length 294 (289); pectoral-fin base depth 72 (67); first dorsal-fin origin to pelvic-fin origin 160 (172); second dorsal-fin origin to anal-fin origin 144 (150); snout length 41 (38); orbit diameter 62 (61); head width 160 (133); body width 113 (111); bony interorbital width 15 (11); snout tip to retroarticular tip 113 (111); caudal-peduncle length 175 (183); caudal-peduncle depth 113 (111); length of first spine of first dorsal fin 67 (83); length of third spine of first dorsal

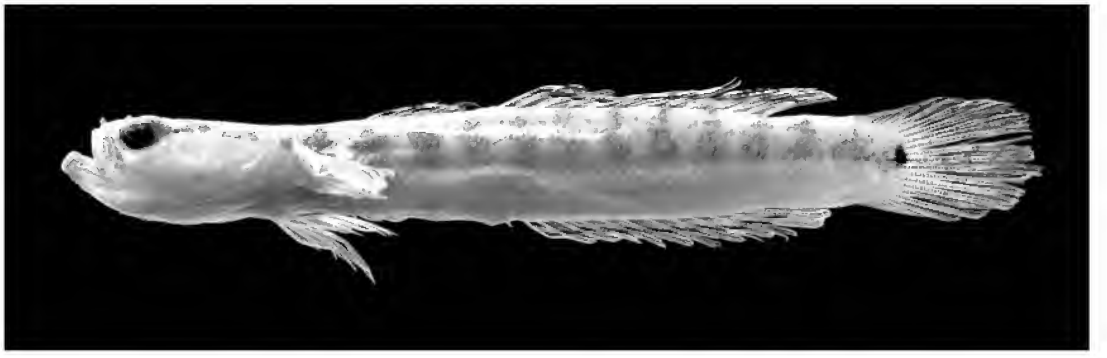

Fig. 3. *Xenisthmus semicinctus*, holotype, WAM P.28025-048, 19.4 mm, male, Clerke Reef, Rowley Shoals, Timor Sea, Australia. (Photo by H. Taylor.)

fin 82 (83); length of sixth spine of first dorsal fin 57 (67); length of spine of second dorsal fin 77 (83); length of first segmented ray of second dorsal fin 98 (94); length of last segmented ray of second dorsal fin 113 (111); anal-fin spine length 62 (67); length of first segmented anal-fin ray 88 (89); length of last segmented anal-fin ray 129 (106); pectoral-fin length 206 (211); fourth segmented pelvic-fin ray length 175 (178); caudal-fin length 201 (211).

Body covered with small scales; scales cycloid on anterior body, ctenoid on mid-side (behind vertical through middle of anal-fin base) and caudal peduncle; ventral contour of body fully scaled, except for narrow area beneath branchiostegal membranes; predorsal broadly scaled to just behind vertical through posterior edge of preopercle, with narrow median wedge of scales extending further forward almost to pore D; cheeks and upper part of operculum scaled; scales present on pectoral-fin base; narrow band of mostly ctenoid scales on fleshy portion of caudal-fin base; no scales on dorsal- or anal-fin bases.

Head pores A'BC D(S)EFHIJK' M'NOPQ'; lower lip fleshy and protruding, with uninterrupted, free ventral margin; anterior naris in short tube; posterior naris with raised rim, with prominent membranous flap anteriorly; tongue indented anteriorly; gill opening extending anteriorly to about midway between verticals through posterior edge of preopercle and posterior edge of eye.

Upper jaw with 3 (anteriorly) or 2 (posteriorly) rows of small, conical teeth, outer-row teeth larger and slightly curved; lower jaw with 3 (anteriorly) or 2 (posteriorly) rows of small, conical teeth, outer-row teeth larger and slightly curved; vomer, palatines and tongue edentate.

Preserved coloration. Head and body beige to pale brown; short, narrow, dark grey-brown stripe extending from mid-anterior orbital rim to mid-side of upper lip; second dark grey-brown stripe extending from mid-posterior orbital rim to shoulder, overlapping upper part of pectoral-fin base; median spot or short bar on upper nape, just anterior to vertical through pectoral-fin base; sides of body with 12 large, dark brown spots, each connecting dorsally to, or almost to, mid-line by short, brown to dark brown bar; first bar and spot just behind pectoral-fin base, second at first dorsal-fin origin, third through middle of first dorsal-fin base, fourth between dorsal fins, next six equally spaced along second dorsal-fin base, final two on caudal peduncle; dorsal fins hyaline with narrow, dark grey-brown stripe along distal third of fins, and series of dark grey-brown spots at base of fins (aligning with bars on body); caudal fin hyaline with short, dark grey to grey-brown bar or spot between third lowest ray on upper hypural plate and upper ray on lower hypural plate, just posterior to their basal tips; bar or spot edged anteriorly with brown to dark brown; remainder of caudal fin with three or four narrow, wavy bars, best developed on upper part of fin; anal fin hyaline with narrow dark grey-brown stripe along distal third of fin; pectoral and pelvic fins hyaline to beige.

Live coloration. Not known.

Comparisons. See Comparisons for *X. eirospilus*.

Remarks. The specific epithet, here treated as a noun in apposition, is derived from the Latin *semis*, meaning half, and *cinctum*, meaning girdle or belt, and alludes to the dark markings on the dorsal part of the body.

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Two New Soleid Flatfishes (Pleuronectiformes: Soleidae: *Soleichthys*) from Australian Waters, With a Re-description of *Soleichthys microcephalus* (Günther)

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ABSTRACT. *Soleichthys microcephalus* (Günther, 1862) occurring in warm temperate waters off New South Wales, Australia, is re-described based on examination of a syntype and additional non-type material. This species differs from congeners in its combination of: low meristic features (43–45 vertebrae, 71–84 dorsal-fin rays, 61–71 anal-fin rays, and 81–89 lateral-line scales); in having two elongated ocular-side pectoral-fin rays of nearly equal length; with small scales present on the ocular-side pectoral-fin base and proximal halves of elongated pectoral-fin rays; in its ocular-side pigmentation consisting of a series of 8–10 mostly complete, bold, wide, dark-brown or blackish crossbands of nearly uniform width throughout their lengths and noticeably wider than the alternating lighter-coloured crossbands; and with two, conspicuous, mid-lateral white spots arranged in horizontal series. Two new species phenotypically most similar to, and with meristic features that largely overlap those of *S. microcephalus*, are described from specimens collected in tropical waters of northern Australia. *Soleichthys serpenpellis* n.sp., known from the Gulf of Carpentaria and Delambre Island, Dampier Archipelago, northwestern Australia, is easily distinguished from *S. microcephalus* and other congeners by its ocular-side head and body pigmentation featuring incomplete, diamond-shaped crossbands broadest in their mid-sections, fewer (about 6) ocular-side body crossbands, and with small, brown spots scattered in the interspaces between the crossbands. *Soleichthys oculofasciatus* n.sp. occurs off northeast Australia and is distinguished from congeners in its combination of a first elongate ocular-side pectoral-fin ray longer than the second, in lacking scales on the ocular-side pectoral-fin base and elongate pectoral-fin rays, in having a longitudinal series of crossbands (usually 11) on the ocular-side head and body, and with four conspicuous white spots on the body, two of which are arranged in a vertical series at mid-body. The new species differs further from both *S. microcephalus* and *S. serpenpellis* in having a longer and narrower head and a longer caudal fin.

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Introduction

Species of the soleid genus *Soleichthys* Bleeker, 1860 are poorly known. Nine nominal species of soles are now placed in *Soleichthys* (*Solea heterorhinos* Bleeker, 1856, *Aesopia multifasciata* Kaup, 1858, *Solea microcephala* Günther, 1862, *Solea tubifera* Peters 1876, *Solea borbonica* Regan, 1905, *Solea nigrostriolata* Steindachner & Kner, 1870, *Solea lineata* Ramsay, 1883, *Soleichthys siammakuti* Wongratana, 1975, and *Soleichthys maculosus* Muchhala & Munroe, 2004), and several other undescribed species are known (Munroe, unpubl. data). Most of the nine nominal species placed in *Soleichthys* were described and remain known only from the holotype or relatively few specimens. Most nominal species of *Soleichthys* are small flatfishes seldom exceeding 180 mm in SL, and most are collected only infrequently using trawls. Some species are observed and photographed by SCUBA divers in coral reef habitats (e.g., Kuiter, 1993), and are often seen during night-time dives when fish are actively moving.

Externally, members of *Soleichthys* have an elongate, tubular, ocular-side anterior nostril; a well-developed ocular-side pectoral fin; no elongate dorsal-fin rays; and they have dorsal and anal fins separate from the caudal fin except for a thin, delicate membrane at the base of the caudal fin. Unlike many other soleids that have uniformly drab ocular-side pigmentation, most species of *Soleichthys* have conspicuous ocular-side pigmentation patterns featuring either boldly pigmented crossbands or other conspicuous markings such as blotches and spots, or with some combination of these markings.

There has not been consistent acceptance or application of generic names for nominal species currently recognized in *Soleichthys*. Bleeker (1860) erected the new genus, *Soleichthys*, to accommodate *Solea heterorhinos* Bleeker, 1856. Kaup (1858) had earlier created a new genus, *Aesopia*, that consisted of five species including *A. multifasciata*, which shares many similarities with *Solea heterorhinos*. Based on Kaup's inclusion of *multifasciata* in *Aesopia*, Chabanaud (1930, 1934) considered *Aesopia* Kaup, 1858, to be the senior synonym of *Soleichthys*. However, of the five species originally composing this genus, Günther had earlier (1862) restricted *Aesopia* Kaup, 1858 to include only *A. cornuta* Kaup, 1858, a distinctive species featuring a greatly elongated first dorsal-fin ray, cycloid scales, and dorsal and anal fins broadly continuous with the caudal fin. Günther (1862) transferred the other four soleid species originally assigned to *Aesopia* Kaup, including *multifasciata*, to *Synaptura*. In the same work, Günther (1862) also described *Solea microcephala* based on two syntypes collected off Sydney Harbour, New South Wales. This species was characterized by several distinctive features including an elongate, tubular ocular-side anterior nostril, dorsal and anal fins terminating immediately before the caudal-fin base, ctenoid scales, and an ocular-side pigmentation featuring a pattern of 11–13 dark brown crossbands. McCulloch (1917) recognized that the elongate, tubular, ocular-side anterior nostril, the separate dorsal, anal and caudal fins, ctenoid scales and the non-elongate first dorsal-fin ray (compared with that of *Aesopia cornuta*) were features shared by *Soleichthys heterorhinos*. Because *Solea microcephala* shared many features with those of *S. heterorhinos*, the type species of *Soleichthys* Bleeker, McCulloch (1917) recommended recognition of *Soleichthys* as the correct generic placement for these species. Subsequent authors (Norman, 1928; Quéro, 1997) have continued to recognize *Soleichthys* as distinct from *Aesopia*.

The number of species of *Soleichthys* considered valid, however, has varied according to different authors and more work is needed to determine the status of many of these nominal species. Most nominal species in the genus, except for *S. microcephalus* and *S. siammakuti*, have, at one time or another, been placed into the synonymy of *S. heterorhinos*. For example, *Solea nigrostriolata* was considered a junior synonym of *S. heterorhinos* by several authors (Günther, 1909; Norman, 1926, 1928; Weber & de Beaufort, 1929; McCulloch, 1929–1930; Chabanaud, 1934). *Solea lineata* has also been considered conspecific with *S. heterorhinos* (McCulloch, 1916, 1917; Norman, 1926, 1928; Weber & de Beaufort, 1929; Chabanaud, 1934), although in other papers (McCulloch, 1921, 1922, 1927), *S. lineata* was tentatively considered a valid species, or was even suggested to be a juvenile *Soleichthys microcephalus*.

Three nominal species of *Soleichthys* recorded from Australian waters are: *S. heterorhinos* from tropical waters off the inner northwestern continental shelf, *S. microcephalus* from off New South Wales, and *S. lineatus*, a species of questionable identity described from a single, small, damaged specimen taken off Port Jackson, New South Wales. A fourth species occurring in the general region is *S. nigrostriolatus*, which is known from specimens taken off Viti-Levu, Fiji Islands.

Of the nominal species of *Soleichthys* reported from or near Australian waters, only *S. heterorhinos* and *S. microcephalus* are presently considered valid by most authors. Although considerable confusion has been associated with other nominal species superficially resembling *S. heterorhinos*, specimens identified in collections as *S. microcephalus*, in contrast, have offered no such confusion, and the presence of more than one species among material identified as this species has not previously been proposed. During examination of soleid material collected from Australian waters and labelled in collections as *S. microcephalus*, we found fishes representing several morphotypes featuring ocular-side pigmentation patterns and other features different from those of *S. microcephalus*. Objectives of this paper are to re-describe *S. microcephalus* based on new material and new characters, and to formally describe those species presently being confused with, and mis-identified as, this species.

Materials and methods

Counts made from radiographs include: epicranial pterygiophore complex, which is the formula representing the number of pterygiophores inserted onto the erisma, followed by the number inserted onto the posterodorsal cranium, with the third number representing the number of pterygiophores associated with the neural spine of the second abdominal vertebra (Chapleau, 1989; Desoutter & Chapleau, 1997). Counts of dorsal-, anal- and caudal-fin rays include all rays counted at their bases. Vertebral counts are reported as the total number of vertebrae. Counts made directly from the specimen include: lateral-line scales, starting dorsal to opercular angle and continuing posteriorly along lateral line to end of hypural plate, but excluding scales extending onto caudal-fin rays; right and left pectoral-fin rays and right and left pelvic-fin rays were also counted directly from the specimen. Measurements were made either on ocular- or blind-side surfaces. All measurements refer to standard length, unless otherwise noted. Measurements <150 mm were taken to the nearest 0.1 mm with dial calipers or an ocular micrometer; measurements >150 mm were taken to the nearest mm. Morphometric features, except standard length (in mm), are expressed either as thousandths of standard length (SL) or head length (HL) and are defined as follows: Standard length (SL): distance from tip of fleshy snout to posterior end of hypural plate. Trunk length (TKL): longitudinal distance from posterior angle of operculum to caudal-fin base. Body depth (BD): greatest distance across body exclusive of fins. Pre-dorsal length (PDL): tip of fleshy snout to base of first dorsal-fin ray. Caudal-fin length (CFL): base of articulations of middle caudal-fin rays to tip of longest (usually middle) rays. Pectoral-fin length (PL): basal articulation to distal tip of longest ray on ocular side. Head length (HL): tip of fleshy snout to most posterior extension of upper fleshy lobe of operculum. Head width (HW): greatest distance across head at anterior portion of operculum. Postorbital head length (POL): posterior margin of fixed (non-migrated) eye to posterior extent of upper fleshy lobe of operculum. Snout length (SNL): anterior rim of fixed eye to tip of snout. Upper jaw length (UJL): shortest horizontal distance from bony tip of premaxilla to angle of mouth. Eye diameter (ED): greatest horizontal diameter of cornea of fixed eye; does not include fleshy tissue surrounding eye.

Qualitative characters also observed for each specimen were: patterns of body and fin pigmentation, especially number, location and types of crossbands and spots; degree of pigmentation on opercles and isthmus regions; positions of posterior margin of lower jaw and anterior nostril relative to fixed eye; location and shape of lateral line; and relative position of the eyes.

Specimens examined are listed in each species account. Abbreviations for collections follow Eschmeyer (1998).

Characters that apply to all three species

Small-sized, dextral flatfishes, featuring a small head and blunt snout without a hook. Blind-side head and snout with numerous cirri (hair-like tufts) anteriorly and along region at bases of anteriormost dorsal-fin rays, some species with cirri best developed posteriorly at gill opening. Ocular-side anterior nostril a prominent elongate tube situated just dorsal to mid-point of upper jaw. Ocular-side posterior nostril a short, wide, ventrally-directed or sometimes erect tube located between posterior base of anterior nostril and anterior margin of fixed eye. Blind-side anterior nostril a short, usually inconspicuous, dorsoposteriorly-directed, wide tube located just dorsal and just anterior to mid-point of lower jaw and surrounded and barely perceptible among dense dermal papillae and cirri on blind-side snout. Posterior blind-side nostril a short, wide, posteriorly-directed tube (ca. twice length of anterior blind-side nostril) located posterior to vertical at posterior margin of jaws, situated at posterior margin of raised area of dense cirri on blind-side snout and offset (slightly dorsal to horizontal through anterior nostril) from anterior blind-side nostril. Mouth small, terminal, with jaws slightly curved ventroposteriorly at their mid-point; mid-region of ocular-side lower jaw with obvious, fleshy, triangular dermal process. Both ocular- and blind-side upper lip connected to snout by frenum. Ocular-side jaws without teeth; blind-side jaws with small bands of villiform teeth best developed posteriorly and with tooth bands on lower jaw generally wider than those of upper jaw. Eyes dextral, contiguous, and slightly subequal (migrated eye slightly anterior to fixed eye); interorbital space narrow and slightly raised, with 2–5 rows of ctenoid scales between anterior margins of eyes, a continuous row of scales between eyes, and with 3–4 scales between posterior margins of eyes. Opercular opening complete, with gill covers connected to each other and free from isthmus. Ocular-side lateral line continuous and straight on body midline from point dorsal to anterior margin of opercle to distal one-third, or distal tip, of middle caudal-fin ray. Lateral line on blind side similar to that on ocular side except pored scales along body at basal region of dorsal fin with well-developed cirri. Dorsal fin extending nearly to base of caudal fin and with posteriormost dorsal-fin ray connected at its base to caudal fin by thin, delicate membrane. Anteriormost dorsal-fin rays unbranched; most others with two (usually) or three branches at their tips. Anal-fin origin just posterior to anus; posteriormost anal-fin ray connected at its base to caudal fin by thin, delicate membrane; some anal-fin rays branched (two or three branches) at their tips. All caudal-fin rays, except dorsalmost and ventralmost, branched. Pectoral fins asymmetrical, that on ocular side longer than its counterpart, connected by membrane to upper pectoral-fin rays. Base of ocular-side pectoral fin about equal to one-third to one-half length of longest pectoral-fin ray. Blind-side pectoral-fin rudimentary. Pelvic fins short and symmetrical, each with 5 unbranched rays; middle fin rays longer than others; pelvic fins separate from each other and from anal fin; posteriormost ocular-side pelvic-fin ray attached to urogenital papilla by thin membrane. Anus located on body midline and surrounded by pelvic fins. Urogenital papilla a short or elongate, bluntly-pointed tube located slightly off body midline on ocular side just posterior to anus.

Soleichthys microcephalus (Günther, 1862)

Figs. 1, 2; Tables 1, 2

Smallhead sole

Solea microcephala Günther, 1862: 466 (original description with counts, measurements; New South Wales, Australia); Kner, 1867: 288 (counts, measurements; off Sydney, New South Wales); Macleay, 1882: 135 (counts, measurements; Port Jackson, New South Wales); Ogilby, 1886: 49 (listed, common in Port Jackson; coastal waters of New South Wales); Waite, 1904: 44 (listed; New South Wales); Stead, 1908: 105 (brief description with figure, size estimate, common in estuaries on mud bottoms; New South Wales); Roughley, 1916: 176 (description, counts, measurements, figure; coast of New South Wales, Australia; common in estuaries).

Soleichthys microcephalus.—McCulloch, 1917: 90 (assigned to *Soleichthys*; New South Wales); McCulloch, 1921: 47 (in key, figure, partial synonymy, uncommon in estuaries; New South Wales); McCulloch, 1922: 37 (in key, figure, partial synonymy, uncommon in estuaries; New South Wales); Norman, 1926: 286–287 (synonymy, in key; New South Wales); McCulloch, 1927: 37 (in key, figure, partial synonymy, uncommon in estuaries; New South Wales); McCulloch, 1929–1930: 283 (listed; New South Wales); Wongratana, 1975: 27 (comparisons with *S. siammakuti*); Yearsley *et al*., 1997 (listed in Appendix D).

Aesopia microcephala.—Chabanaud, 1930: 555 (assigned to *Aesopia*); Chabanaud, 1934: 427 [in key; counts, including vertebrae; considered *S. borbonica* (Regan) as a subspecies of *A. microcephala* (Günther)]; Kuiter, 1993: 389 (description; size to 22 cm; colour photographs, including juvenile; New South Wales in estuaries and inshore waters, at 3–20 m).

Aesopia microcephalus.—Munro, 1938: 70 (description, with counts, measurements, colour figure; New South Wales).

Type material. SYNTYPE, BMNH 1855.9.19.1247, 159 mm SL, Australia.

Other material examined. AMS I.26311-003, 151.1 mm SL, east of Urunga, 30°27–32'S 153°8'E, 33–43 m; AMS I.37360-001, 145.1 mm SL, off Newcastle 32°51'S 151°55'E, 31–34 m; AMS I.37372-001, 4(151.3–169.4 mm SL), off Newcastle, 32°51'–52'S 151°53'E; AMS I.19117-003, 137.0 mm SL, Sydney Harbour 33°48'S 151°14'E; USNM 59956, 140.2 mm SL, off Port Jackson 33°51'S 151°16'E; USNM 47886, 2(122.8–159.7 mm SL), off Port Jackson 33°51'S 151°16'E; AMS I.1103, 171.7 mm SL, off Port Jackson 33°51'S 151°16'E; QM I.1189, 171.0 mm SL, off Port Jackson 33°51'S 151°16'E; QM 1191, 165.1 mm SL, off Port Jackson, 33°51'S 151°16'E; QM 1192, 113.4 mm SL, off Port Jackson 33°51'S 151°16'E.

Distinguishing characters. *Soleichthys microcephalus* is readily distinguished from congeners by its combination of: low meristic features (43–45 vertebrae, 71–84 dorsal-fin rays, 61–71 anal-fin rays, and 81–89 lateral-line scales), its ocular-side pigmentation pattern consisting of a series of 8–10 dark-brown to black, mostly complete crossbands on the body, with body crossbands noticeably wider than the alternating lighter-coloured crossbands, with three dark-brown crossbands continuous across head, two conspicuous white spots in longitudinal series on the ocular-side midline, in having two elongated ocular-side pectoral-fin rays of nearly equal length or with the second fin ray longer than first, and in having small scales present on bases and proximal halves of elongated ocular-side pectoral-fin rays.

Description. Meristic and morphometric features for a syntype and 14 non-type specimens are summarized in Tables 1 and 2. Body oblong, greatest depth at point between gill opening and just anterior to body mid-point, body depth nearly uniform throughout most of length with rapid taper only in posterior one-fifth of body; body thick, especially in region of pectoral fins. Head ca. 0.41–0.45 BD; wider than long (HW ca. 1.3–1.5 HL), with dorsal and ventral contours smoothly arching posteriorly. Snout slightly squarish in anterior profile; about equal to or just slightly longer than ED; snout tip slightly anterior to horizontal through dorsal margin of fixed eye. Ocular-side anterior nostril usually extending to mid-point of fixed eye when depressed posteriorly. Posterior margin of jaws usually reaching to vertical through anterior margin of pupil of fixed eye. Ocular-side lips generally smooth; blind-side lips with obvious plicae. Gill covers fringed with conspicuous cirri, especially that on blind side; ocular-side opercle connected

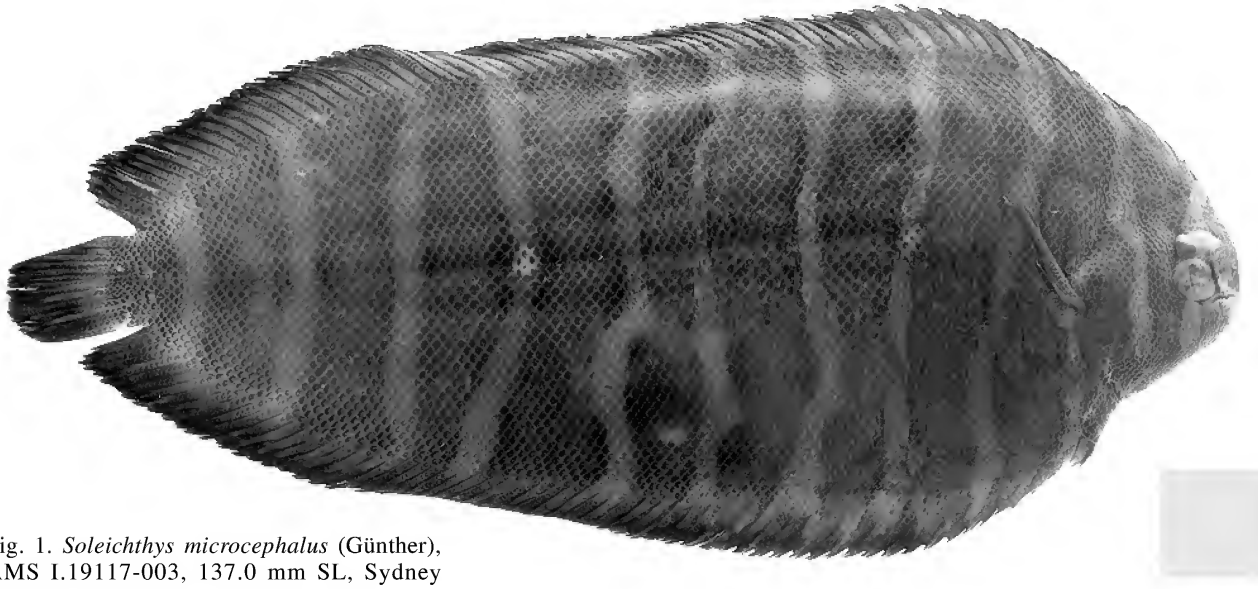

Fig. 1. *Soleichthys microcephalus* (Günther), AMS I.19117-003, 137.0 mm SL, Sydney Harbour, Australia, 33°48'S 151°14'E.

Table 1. Selected meristic features for three Australian species of *Soleichthys*. Asterisk * indicates value for holotype or syntype.

	total vertebrae				
species	43	44	45	46	mean
S. serpenpellis	–	1	4*	–	44.8
S. oculofasciatus	–	–	1	1*	45.5
S. microcephalus	3	7	4	–	44.1

	dorsal-fin rays														
species	71	72	73	74	75	76	77	78	79	80	81	82	83	84	mean
S. serpenpellis	–	–	–	–	–	1	–	1	1*	–	–	–	–	2	80.2
S. oculofasciatus	–	–	–	–	–	–	–	–	1	–	1*	–	–	–	80.0
S. microcephalus	1	–	–	2	3	1*	3	1	3	–	–	–	–	1	76.7

	anal-fin rays														
species	58	59	60	61	62	63	64	65	66	67	68	69	70	71	mean
S. serpenpellis	–	–	–	–	–	–	1*	–	–	1	1	–	–	2	68.2
S. oculofasciatus	–	–	–	–	–	–	–	–	–	–	2*	–	–	–	68.0
S. microcephalus	–	–	–	2	–	3	1	1	4*	–	–	3	–	1	65.5

	lateral line scales															
species	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	mean
S. serpenpellis	–	–	1	–	–	–	1	–	–	2*	–	–	–	–	1	89.0
S. oculofasciatus	–	–	–	–	1*	1	–	–	–	–	–	–	–	–	–	85.5
S. microcephalus	1	1	2	1	3	4	–	1*	2	–	–	–	–	–	–	85.2

by thin membrane to dorsalmost pectoral-fin rays (usually rays 1–3 or 1–4) from their bases to mid-points. Blind-side opercle broadly connected by thick membrane to entire lengths of first three or four blind-side pectoral-fin rays. Ocular-side lateral line arching anteriorly over operculum and continuing onto head to about region dorsal to anterior margin of migrated eye. Dorsal-fin origin on midline of head usually at vertical equal to point between mid-point and anterior margin of migrated eye, or just slightly anterior to anterior margin of eye. Anterior dorsal-fin rays shorter than others. Dorsal-fin pterygiophore formula 1-0-2 or 1-1-2. Ocular and blind sides of dorsal- and anal-fin rays noticeably scaly; anterior dorsal- and anal-fin rays with small ctenoid scales basally (anterior rays of blind-side dorsal and anal fins usually without scales); at approximately body mid-point, both sides of dorsal and anal fins with series of ctenoid scales covering proximal one-third to one-half of fin rays; in posterior one-third of body, scales on dorsal- and anal-fin rays gradually increasing in number and eventually covering nearly entire lengths of fin rays or at least proximal two-thirds of their lengths. Caudal fin relatively large with distal margin nearly square; with 16–18 caudal-fin rays. Both sides of caudal fin scaly nearly to distal tips of fin rays. Ocular-side pectoral fin long, pointed, with 8–11 rays, the two dorsalmost rays elongate with remainder progressively decreasing in size. Ocular-side elongate pectoral-fin rays nearly equal in length, or with second ray slightly longer than first; elongated pectoral-fin rays covered with strong ctenoid scales on proximal one-third of their lengths; remainder of fin scaly on basal region. Blind-side pectoral fin squarish, with 7–11 short rays, those in dorsal third of fin longer than others; blind-side pectoral fin with a few small scales along bases of fin rays and with noticeably scaly fin base. Base of ocular-side pelvic fin slightly anterior to that of blind-side fin. Scales on body relatively small and rounded, slightly wider than long and strongly ctenoid. Ctenii on blind-side body scales not as strongly developed as those on ocular-side scales. Lateral-line scales smaller than surrounding scales, cycloid, diamond-shaped, and with small, slightly elevated pore.

Pigmentation (based on live specimen from Kuiter, 1993). General background colouration of ocular side light brown with a series of prominent, dark-brown to black crossbands alternating with lighter-brown crossbands. Ocular side of head with three black and one white crossbands continuous across head and with one incomplete black band from dorsal margin to about midpoint of head (about equal with horizontal through migrated eye); anteriormost black crossband located on snout and chin; second black crossband located immediately posterior to eyes; third black band crossing head at distal margin of opercle. White band crossing head at posterior region of eyes. Upper surfaces of eyes white. Anterior ocular-side nostril conspicuously dark-brown to black. Body usually with nine, black, relatively straight, crossbands of nearly uniform width and bands usually continuous across body from base of dorsal fin to base of anal fin. Total number of black crossbands (head and body combined) 13. Crossbands on body broader, sometimes as much as twice as wide, than proximate lighter-coloured crossbands. Dark crossbands sometimes extending onto dorsal and anal fins. No conspicuous, rounded, white spots in longitudinal series on midline of ocular side of body. Ocular sides of dorsal, anal and caudal fins brilliantly pigmented with alternating series of mostly similarly-sized bright blue and black blotches throughout entire lengths of fins.

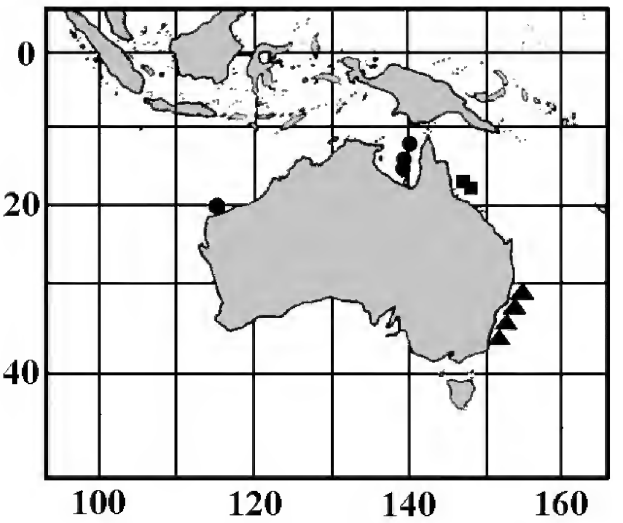

Fig. 2. Capture locations for three Australian species of *Soleichthys*. ▲ = *S. microcephalus*; ● = *S. serpenpellis*; ■ = *S. oculofasciatus*.

Life colours of a juvenile specimen (Kuiter, 1993), photographed in July at about 5 m in Camp Cove, Sydney Harbour (Kuiter, pers. comm.), strikingly different than that of adult. Ocular surface background coloration uniformly off-white with an irregular series of rounded or oblong darker blotches posterior to pectoral fin. Anterior snout, upper lip, and especially anterior ocular-side elongate nostril, dark black. Mouth and ventral margin of head silhouetted in orange. Basal halves or slightly more of dorsal, anal and caudal fins with similar coloration as that of body; two continuous longitudinal bands of darker pigment on distal halves of these fins, an inner orange band situated at about two-thirds the length of the fin rays which is bordered throughout lengths of fins by distally positioned dark-black band.

Pigmentation (in alcohol, Fig. 1). General background coloration of ocular side dark brown with a series of prominent, darker-brown to black crossbands alternating with yellowish to cream-coloured crossbands. Ocular side of head with three dark-brown or black crossbands continuous across head; anteriormost crossing snout and chin; second crossband located immediately posterior to eyes; third crossband on body dorsally and crossing head on distal margin of opercle. Interorbital space and upper surfaces of eyes dark brown. Posterior one-third of anterior ocular-side nostril dark brown; basal two-thirds of nostril whitish. Body with 8–10, dark-brown or black, relatively straight, crossbands of nearly uniform width and usually continuous across body from base of dorsal fin to base of anal fin; occasionally crossbands in body mid-region interrupted in their mid-sections. Total number of crossbands (head and body combined) 11–13. Crossbands on body broader, sometimes as much as twice as wide, than proximate lighter-coloured crossbands. Both dark and lighter crossbands extending onto dorsal and anal fins in anterior one-half of body. Ocular side of body on some specimens with two, conspicuous, rounded, similar-sized white spots in longitudinal series on midline, one situated above posterior tips of elongated pectoral-fin rays between dark body crossbands 1–2 and the other on posterior one-third of body between dark crossbands 5–6. White spots nearly equal to, or slightly smaller than, eye diameter. Isthmus and inner opercular lining on ocular side dark with numerous pepperdot melanophores; blind-side inner opercular linings and isthmus with pepper dots. Inner lining of mouth black. Blind side generally uniformly whitish to yellowish, with dense concentrations of pepperdot melanophores on body regions overlying pterygiophores of dorsal and anal fins. Pepper dots extending onto body scales in middle and posterior quarter of blind-side body in more darkly-pigmented specimens. Ocular sides of dorsal and anal fins darkly pigmented; each with continuous, uniformly black or dark-brown longitudinal band on distal one-half of fin rays throughout lengths of these fins, which widens on dorsal and anal fins in posterior one-half of body; basal halves of dorsal and anal fins usually lighter than distal halves; distalmost tips of dorsal- and anal-fin rays white. Blind sides of dorsal and anal fins uniformly black throughout their lengths. Ocular-side pectoral fin darkly pigmented; that on blind side whitish at base. Pelvic fins uniformly brown, except posteriormost part of blind-side fin with lighter pigment consisting of scattered melanophores. Ocular side of caudal fin with dark band on basal one-third of fin rays; with lighter band on middle one-third of fin; and with dark black band on distal one-third of fin forming continuous outline with black band on dorsal and anal fins; distalmost tips of caudal fin white. Blind side of caudal fin yellowish on its basal half, dark black on its distal half, and with fin-ray tips white.

Distribution and habitat (Fig. 2). Warm-temperate estuarine and neritic waters of New South Wales, Australia, from about 33°52'S to 30°27'S. Occurs on muddy bottoms in estuaries, harbours and in coastal waters at 3–20 m (Stead, 1908; Roughley, 1916; Kuiter, 1993). The few museum collections with accompanying depth data indicate that this species is taken from shallow waters to depths of at least 43 m.

Remarks. Chabanaud (1934) considered *Solea borbonica*, a species described on the basis of a single specimen, as part of a subdivision of a subspecies in his expanded taxon, *Aesopia japonica microcephala* natio *borbonica*. Quéro (1997) re-examined the holotype of *Solea borbonica* and concluded that *S. borbonica* was instead a valid species of *Soleichthys* that is endemic to Reunion Island, Indian Ocean. Fricke (1999), after comparing results of his study of the holotype of *Solea tubifera* Peters collected at Mauritius, concluded that *S. tubifera* and *S. borbonica* were conspecific, and therefore, *S. tubifera* was the appropriate name for this species. *Soleichthys tubiferus* (including *S. borbonicus*) differs most distinctively from *S. microcephalus* in its ocular-side coloration (uniformly greyish brown without crossbands) and more numerous (97 vs. 89 or less) lateral-line scales.

McCulloch (1921, 1922, 1927) tentatively suggested that *Solea lineata* Ramsay, 1883, described from a small, damaged specimen taken off Port Stephens, NSW, was a juvenile *S. microcephalus*, or more likely, based on its coloration (6 narrow crossbands on head, 25 crossbands on body) this nominal species was conspecific with (McCulloch, 1916, 1917), or a distinct species but one closely resembling *S. heterorhinos* (McCulloch, 1921, 1922, 1927). Whether *Solea lineata* and *S. heterorhinos* are conspecific needs further study. However, based on ocular-side colour patterns (numerous, narrow crossbands in *S. lineatus* vs. fewer, wider crossbands in adult *S. microcephalus* and uniformly pigmented ocular side without crossbands in juvenile *S.*

Table 2. Summary of selected morphometrics for syntype (BMNH 1855.9.19.1247) and 14 non-type specimens of *Soleichthys microcephalus*. Abbreviations defined in *Materials and methods* section; SL expressed in mm; other characters expressed in thousandths of SL; 13–17 in thousandths of HL; * indicates only 13 specimens measured; SD, standard deviation.

character	syntype	non–type specimens range	mean	SD
SL	166	113.4–172	151.5	18.02
PDL	36	19–38	26.1	4.63
BD	363	357–446	406.8	24.44
PL	—	78–122	98.4	10.10
CFL	125	126–145*	134.3	6.10
TKL	803	818–903	843.4	22.26
HL	167	160–181	172.1	6.37
HW	216	198–256	227.1	15.30
POL	78	89–119	101.1	8.79
SNL	28	29–47	39.6	5.00
UJL	54	28–44	37.1	3.98
ED	38	28–41	35.1	4.05
HW	1296	1112–1513	1323.1	113.19
POL	466	512–668	588.2	52.71
SNL	166	182–270	229.7	28.02
UJL	321	178–256	215.8	20.16
ED	227	169–237	203.6	20.72

microcephalus; see photo in Kuiter, 1993) and higher and non-overlapping meristic features for the holotype of *S. lineatus*: 95 dorsal-fin rays, 80 anal-fin rays, 109 lateral-line scales (scale count according to McCulloch, 1916), this nominal species is distinct from *S. microcephalus*.

Comparisons. *Soleichthys microcephalus* is readily differentiated from *S. heterorhinos, S. nigrostriolatus, S. lineatus* and *S. multifasciatus* by its lower meristic features (43–45 vs. 48–53 total vertebrae, 71–84 vs. 85–105 dorsal-fin rays, 61–71 vs. 74–91 anal-fin rays and 81–89 vs. 100–124 lateral-line scales in these other species, respectively) and in its pigmentation pattern including having only three crossbands (vs. 5 or more) on its head and in having fewer (8–10), wider crossbands on the body (vs. 17–31 crossbands in these others). It is distinguished from *S. serpenpellis* (see below) in body shape, and conspicuous differences in colour pattern, especially in having complete, and more numerous, crossbands on its ocular surface (compare Figs. 1 and 3). *Soleichthys microcephalus* is readily distinguished from *S. oculofasciatus* (see below) in having two equally elongated ocular-side pectoral-fin rays and by the presence of scales on these ocular-side pectoral-fin rays (vs. first pectoral-fin ray longer than second and scales absent on pectoral fin in *S. oculofasciatus*) and by its different body shape and ocular-side coloration (compare Figs. 1 and 4). *Soleichthys microcephalus* is readily distinguished from *S. siammakuti* and *S. maculosus* by its ocular-side colour pattern featuring bold, wide crossbands and in lacking conspicuous spots on the dorsal, anal and caudal fins (vs. crossbands not bold and wide or absent altogether, and spots present in these others). *Soleichthys microcephalus* differs conspicuously from *S. tubiferus* which has a uniformly pigmented ocular side (vs. prominent crossbands in *S. microcephalus*) and higher, non-overlapping counts of dorsal- and anal-fin rays, and lateral-line scales (see Remarks above).

Soleichthys serpenpellis n.sp.

Figs. 2, 3; Tables 1, 3

Snakeskin sole

Type Material. HOLOTYPE, AMS IB.7211, 122.7 mm SL, Gulf of Carpentaria, 12–18°S 139–143°E. PARATYPES: AMS I.15557-066, 2(103.4–125.3 mm SL), Gulf of Carpentaria, 17°29'S 140°45'E, 4 m; QM I.11204, 117.8 mm SL, Gulf of Carpentaria, 16°35'55"S 140°48'20"E, 9 m; WAM P5739, 100.0 mm SL, Delambre Island, Dampier Archipelago off northwestern Australia, 21°S 117°E.

Distinguishing characters. *Soleichthys serpenpellis* is readily distinguished from all congeners by its combination of: low meristic features (44–46 vertebrae, 76–84 dorsal-fin rays, 64–71 anal-fin rays, and 83–95 lateral-line scales), a series of six incomplete, diamond-shaped crossbands on the ocular surface that are widest in their mid-sections and wider than respective interspaces between crossbands, with small, brown spots scattered in the interspaces between ocular-side crossbands, with three crossbands on the head, in having two white spots in longitudinal series along the midline of the ocular-side body, in its two elongated ocular-side pectoral-fin rays of nearly equal length or with the second fin ray longer than the first, and in having small scales present on bases and proximal halves of elongated ocular-side pectoral-fin rays.

Description. Meristic and morphometric features for the holotype and four paratypes are summarized in Tables 1 and 3. Body moderately elongate with nearly straight dorsal contour anteriorly, greatest depth (about 2.75 in SL) at a point in the anterior 33–50% of body length; taper gradual in posterior one-fifth of body; body thick, especially in region of pectoral fins. Head ca. 0.44 BD; wider than long (HW ca. 1.2–1.5 HL) with its ventral contour gently sloping posteriorly. Snout bluntly rounded, smaller than ED; snout tip on horizontal line through centre of fixed eye. Blind-side head with a few widely-spaced cirri also present along posterior margin of opercle. Ocular-side anterior nostril extending to about anterior margin of fixed eye when depressed posteriorly. Posterior margin of jaws at vertical through anterior margin of pupil of fixed eye. Lips fleshy, with longitudinal plicae. Eyes large (ED > SNL) and conspicuous, oval. Gill cover with fleshy membranous attachment to bases of three dorsalmost pectoral-fin rays on ocular side; on blind side, gill cover broadly connected by thick membrane to dorsalmost two or three pectoral-fin rays for nearly one-half their lengths. Ocular-side gill cover without obvious cirri; blind-side gill cover with cirri present along posterior border. Ocular-side lateral line anteriorly with small, curved portion posterior to migrated eye and extending dorsal to horizontal at dorsal margin of migrated eye. Dorsal-fin origin on body midline usually at vertical anterior to anterior margin of migrated eye. Dorsal-fin pterygiophore formula 1-1-2 (holotype and 3 paratypes) or 1-0-2 (1 paratype). Middle dorsal-fin rays slightly longer than those in other regions of fin. Both sides of dorsal-fin rays from a point anterior to mid-point of fin with a single row of ctenoid scales on their proximal halves; at approximately body mid-point to posterior end of dorsal fin, both sides of fin rays covered for nearly four-fifths their lengths with single row of small ctenoid scales. Proximal

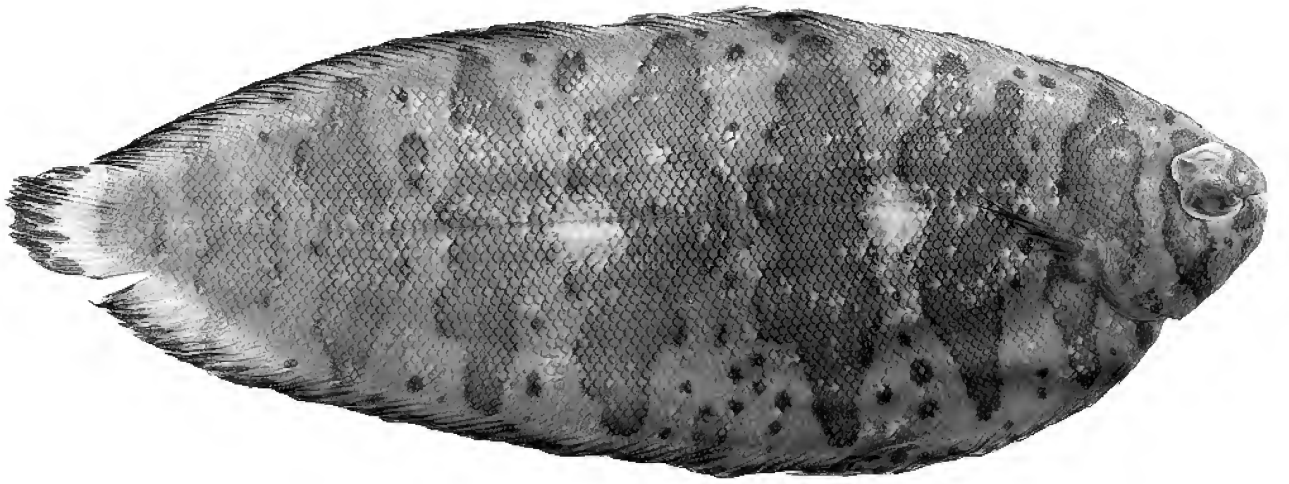

Fig. 3. *Soleichthys serpenpellis*, holotype, AMS IB.7211, 122.7 mm SL, Gulf of Carpentaria, Australia, 12–18°S 139–143°E.

halves of both sides of anal-fin rays in anterior one-fifth of fin covered with single row of ctenoid scales; scales gradually increasing in number (but not rows) posteriorly and eventually covering nearly proximal four-fifths of fin rays in posterior portions of anal fin. Caudal fin broadly rounded and relatively large, with 18–19 fin rays. Proximal three-fourths of ocular side of caudal fin scaly; scales covering only proximal half of blind side of caudal fin. Ocular-side pectoral fin long, pointed, with 8–9 fin rays, the two dorsalmost rays elongate with remainder decreasing in size progressively. Second ocular-side pectoral-fin ray slightly longer than first and nearly equal to head length; elongated pectoral-fin rays scaly for proximal one-third of their lengths; remainder of fin scaly only on basal region. Blind-side pectoral fin rounded, with 6–8 relatively short fin rays; two dorsalmost rays longer than remainder, which are nearly equal in size; pectoral-fin base about equal to length of longest blind-side fin ray; blind-side pectoral-fin rays not noticeably scaly, but with some scales on blind-side pectoral-fin base. Blind-side pelvic fin nearly on body midline; ocular-side pelvic fin with anteriormost ray on body midline and with remainder of fin rays dorsal to midline on right side. Scales on body small, strongly ctenoid, rhomboid, with ctenii in centre of scale more strongly developed than those on dorsal or ventral margins. Lateral-line scales small, rounded, cycloid, and with slightly raised pore.

Pigmentation (in alcohol, Fig. 3). Ocular-side background coloration generally light- to medium-brown with a series of 9–10 prominent darker crossbands from snout tip to base of caudal fin and with two conspicuous, rounded, white spots equal to, or slightly larger than, eye diameter in longitudinal series on body midline. Anterior spot situated between first and second crossband on body; posterior spot between crossbands 3 and 4. Body usually with 6–7, dark-brown, complete or nearly complete, crossbands covering body from base of dorsal fin to base of anal fin; crossbands in mid-body region of some specimens generally broader than others, with central regions wider than areas nearer bases of dorsal and anal fins. Body crossbands broader and more darkly pigmented than respective light-tan interspaces. Crossbands in anterior one-half of body nearly straight across vertical axis of body, whereas borders of posterior crossbands often with wavy appearance. Crossbands not bordered by spots, but interspaces between crossbands on body and on head posteriorly with numerous, round dark-brown spots and irregular blotches. Head with three, dark-brown, continuous crossbands; the first on anterior snout and chin, second crossing region between middle and posterior margin of eyes and third crossband located posteriorly on head and gill cover. Ocular-side anterior nostril uniformly brown throughout its length. Mouth lining black. Inner opercular linings and isthmus on both sides with dense concentration of melanophores. Blind side uniformly yellowish-white, with scattering of pepperdot melanophores on scales along pterygiophore regions of dorsal and anal fins. Basal halves of ocular sides of dorsal and anal fins light tan similar to background coloration on body. Ocular sides of dorsal- and anal-fin rays with dense concentrations of melanophores throughout lengths of fin rays. Pigment intensifying on distal thirds or less of ocular sides of dorsal- and anal-fin rays, exclusive of tips, and

Table 3. Summary of selected morphometrics for the holotype (AMS IB.7211) and four paratypes of *Soleichthys serpenpellis*. Abbreviations defined in *Materials and methods* section; SL expressed in mm; other characters expressed in thousandths of SL; 13–17 in thousandths of HL; SD, standard deviation.

character	holotype	paratypes		
		range	mean	SD
SL	122.7	100.0–125.3	111.2	11.94
PDL	27	23–37	30.5	5.97
BD	373	350–382	362.2	14.24
PL	128	106–169	137.8	25.77
CFL	138	126–140	132.5	7.05
TKL	832	807–842	818.2	16.01
HL	165	153–177	167.2	11.09
HW	192	187–259	219.8	29.64
POL	79	85–103	91.0	8.16
SNL	38	32–47	39.5	7.59
UJL	32	35–47	40.8	6.65
ED	51	33–47	42.8	6.55
HW	1163	1056–1481	1318.5	186.12
POL	478	497–582	543.8	42.76
SNL	227	207–262	234.2	30.90
UJL	192	212–271	243.0	27.26
ED	310	186–292	257.8	48.47

forming continuous or nearly continuous longitudinal dark-brown to blackish band throughout entire lengths of fins. Longitudinal band solid in some regions and in others comprised of two parallel rows of irregular spots covering several fin rays and joining membrane; spots frequently coalesce into larger, darkly pigmented blotches in some areas of these fins. Distal band darkest on posterior one-third of dorsal and anal fins. Distal tips of dorsal- and anal-fin rays in anterior region of fin whitish. Blind sides of dorsal and anal fins with melanophores throughout length of fin rays and with dark, blackish-brown band on distal two-thirds of fins in anterior two-thirds of body, and with band on distal one-third of fins in posterior region of body. Ocular side of caudal fin with medium-brown band on proximal one-third of fin rays; middle one-third of caudal fin tan-coloured with lighter concentration of melanophores; and distal one-third of fin with dark (blackish) band continuous with that of dorsal and anal fins. Blind side of caudal fin white basally, with dark melanophores on middle third, and with more solid blackish-brown pigment on distal one-third of fin. Ocular-side pectoral fin with uniformly brown pigment throughout length of fin rays, with distal tips of elongated fin rays white, and with darker, nearly black, pigment streaks on membrane between elongated fin rays; blind-side pectoral fin with pepperdot melanophores on fin and sometimes also with pepper dots on body scales immediately behind blind-side pectoral fin. Pelvic fins blackish-brown with membrane more darkly pigmented than most fin rays.

Distribution and habitat (Fig. 2). Tropical waters of northern Australia; four specimens were taken in the Gulf of Carpentaria, Queensland (18°S–16°35'S), and a single specimen was captured east of Delambre Island, Dampier Archipelago, northwestern Australia (21°S 117°E). The available specimens were captured in depths of 4–9 m.

Etymology. From the Latin, *serpen*, snake, and *pellis*, skin; in reference to the distinctive ocular-side pigmentation pattern in this species that is reminiscent of a snake-skin colour pattern.

Comparisons. *Soleichthys serpenpellis* is readily differentiated from *S. heterorhinos, S. nigrostriolatus, S. multifasciatus* and *S. lineatus* by its lower meristic features (44–45 vs. 48–53 total vertebrae, 76–84 vs. 85–105 dorsal-fin rays, 64–71 vs. 74–91 anal-fin rays and 83–95 vs. 100–124 lateral-line scales in these other species, respectively) and in its pigmentation pattern including fewer (6–7), wider crossbands on its body (vs. 17–31 crossbands in these others). It differs from *S. heterorhinos, S. nigrostriolatus*, and *S. multifasciatus* in having only three crossbands on its head (vs. usually five or more in these others). *Soleichthys serpenpellis* differs from *S. microcephalus* and *S. oculofasciatus* (see below) in having incomplete, diamond-shaped crossbands on the body (vs. complete bands of different shape in these other species), in having fewer total ocular-side crossbands than these others, and in having numerous brown spots distributed among ocular-side crossbands (vs. brown spots lacking in these others). *Soleichthys serpenpellis* is further distinguished from *S. oculofasciatus* in having only two, conspicuous white spots situated mid-laterally in a horizontal series on the ocular side (vs. four white spots with two arranged in vertical series), in having the second elongated pectoral-fin ray as long as or longer than the first (vs. second elongated pectoral-fin ray shorter than first), and in having scales on elongated rays of the ocular-side pectoral fin (vs. scales lacking on elongated pectoral-fin rays). *Soleichthys serpenpellis* also differs from *S. oculofasciatus* in having a shorter and wider head and a shorter caudal fin (compare respective data in Tables 3 and 4). *Soleichthys serpenpellis* differs from *S. siammakuti* and *S. maculosus* in lacking spots on the fins characteristic of these other species. *Soleichthys tubiferus* is most easily distinguished from the new species by its uniformly pigmented ocular side (vs. prominent crossbands in *S. serpenpellis*).

Soleichthys oculofasciatus n.sp.

Figs. 2, 4; Tables 1, 4

Banded-eye Sole

Type material. HOLOTYPE: QM I.23589, 107.7 mm SL, Trunk Reef, Australia, 18°23.5'S 146°45'E, 49 m. PARATYPE: QM I.23194, 124.6 mm SL, N. Cape Bowling Green, 19°9'S 147°24'E, 28 m.

Distinguishing characters. *Soleichthys oculofasciatus* is readily distinguished from congeners in having a combination of: low meristic features (45–46 vertebrae, 79–81 dorsal-fin rays, 68 anal-fin rays, and 85–86 lateral-line scales), a series of 11 complete crossbands on the ocular side that are wider than their respective interspaces, four conspicuous white spots on its ocular surface with two arranged in vertical series, three crossbands on the head, two elongate ocular-side pectoral-fin rays with the first fin ray noticeably longer than the second, and in lacking scales on the ocular-side pectoral-fin base and proximal halves of elongated ocular-side pectoral-fin rays.

Description. Meristic and morphometric features for the holotype and paratype are summarized in Tables 1 and 4. Body elongate, greatest depth (about 2.5 in SL) in anterior one-third of body; taper gradual in posterior one-fifth of body; body thick, especially in region of pectoral fins. Head ca. 0.52 BD; narrow; head width equal to, or slightly larger than, head length; dorsal and ventral contours of head gently sloped posteriorly. Snout bluntly squarish; about equal to or slightly larger than eye diameter; snout tip on horizontal through ventral region of fixed eye. Ocular-side snout without dermal papillae or conspicuous cirri; blind-side snout with well-developed papillae and cirri in nostril region and along dorsal profile overlying pterygiophore region. Ocular-side anterior nostril when depressed posteriorly usually extending to point between anterior margin and middle of fixed eye. Posterior margin of jaws at point between verticals through anterior margin of pupil and anterior margin of fixed eye. Ocular-side upper lip smooth, lower lip with longitudinal plicae. Blind-side lips with several obvious plicae. Eyes large (ED > SNL), conspicuous, oval. Opercles without obvious cirri. Gill covers with fleshy membranous attachment to dorsalmost pectoral-fin rays in each fin; on the ocular-side, opercular membrane extends from bases to about half-way point of two longest fin rays; blind-side opercular membrane thicker and connected to dorsalmost two or three pectoral-fin rays from their bases nearly to their distal tips. Ocular-side lateral line anteriorly with noticeably curved portion on opercle and continuing anteriorly onto head and terminating at point dorsal to, and

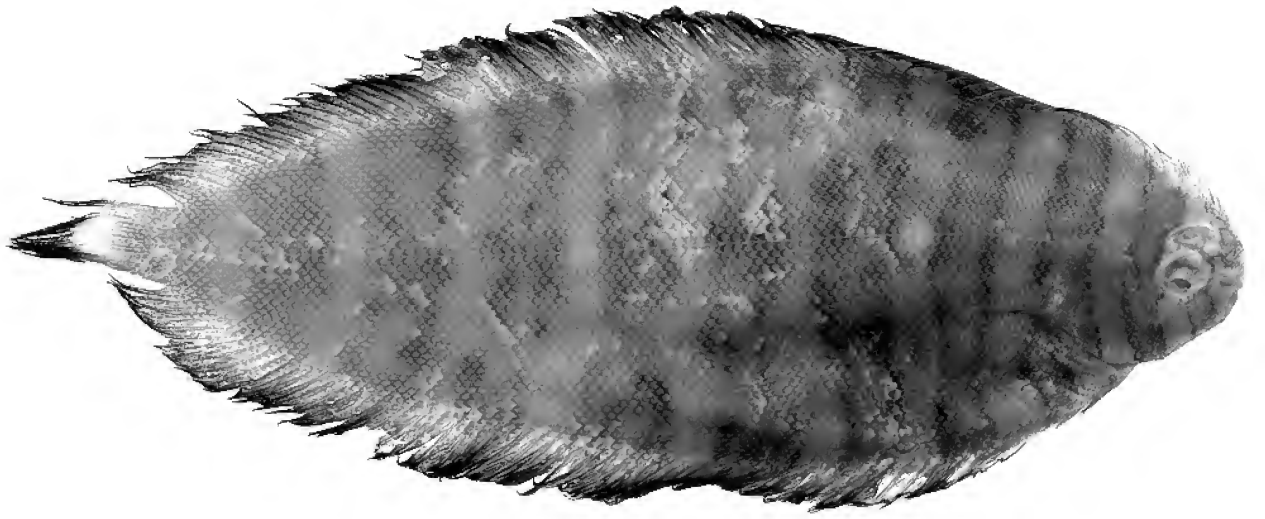

Fig. 4. *Soleichthys oculofasciatus*, holotype, QM I.23589, 107.7 mm SL, Trunk Reef, Australia, 18°23.5'S 146°45'E.

posterior of, migrated eye. Dorsal-fin origin on midline, usually at vertical between mid-point of upper jaw and anterior margin of migrated eye. Dorsal-fin pterygiophore formula 1-2-2 (holotype) or 2-0-2 (paratype). Dorsal-fin rays nearly equal in length throughout fin. Basal one-third of ocular sides of dorsal-fin rays in anterior region of fin covered with small ctenoid scales; in posterior two-thirds of fin, fin rays with scales covering about three-fourths of their lengths. Anal-fin rays about equal in length throughout fin. Ocular sides of anal-fin rays mostly without scales, except that anterior anal-fin rays with small ctenoid scales on their basal regions. Blind sides of dorsal- and anal-fin rays without scales in anterior two-thirds of fin and with scales covering basal portion to about one-third length of fin rays in posterior thirds of these fins. Caudal fin rectangular, long, with nearly all fin rays of equal length; with 18 fin rays. Proximal one-half of ocular side of caudal fin covered with ctenoid scales; blind side of caudal fin with scales covering basal one-third of fin and also extending to about mid-point of some caudal-fin rays. Ocular-side pectoral fin long, pointed, with 11 rays; two dorsalmost rays elongated, with consecutive fin rays becoming progressively shorter. First ocular-side pectoral-fin ray noticeably longer than second (length of longest fin ray nearly equal to POL); elongated pectoral-fin rays without scales; remainder of fin scaly only on its basal region. Blind-side pectoral fin short, rounded, with 10–11 relatively short fin rays; blind-side pectoral-fin rays and fin base not noticeably scaly. Blind-side pelvic fin nearly on body midline, ocular-side pelvic fin situated slightly on right side of body. Scales on body small, somewhat pointed in centres, strongly ctenoid with ctenii best developed in central region of scales. Lateral-line scales small, cycloid, with small, slightly raised pore.

Table 4. Summary of selected morphometrics for the holotype (QM I.23589) and paratype (QM I.23194) of *Soleichthys oculofasciatus*. Abbreviations defined in *Materials and methods* section; SL expressed in mm; other characters expressed in thousandths of SL; 13–17 in thousandths of HL; SD, standard deviation.

	character	holotype	paratype
1	SL	107.7	124.6
2	PDL	22	24
3	BD	362	363
4	PL	102	—
5	CFL	168	149
6	TKL	819	831
7	HL	191	185
8	HW	191	193
9	POL	108	104
10	SNL	40	37
11	UJL	44	43
12	ED	37	38
13	HW	1000	1043
14	POL	563	565
15	SNL	209	200
16	UJL	228	235
17	ED	194	204

Pigmentation (in alcohol, Fig. 4). Ocular-side background colouration medium- to dark-brown with a series of 11 continuous, mostly straight, darker-brown crossbands on head and body and with at least four conspicuous, rounded white spots on body. Head with three continuous crossbands, anteriormost crossing snout and chin, middle band passing immediately posterior to eyes, and posteriormost band on posterior head and opercle. Eight crossbands of nearly uniform width throughout their lengths extending continuously across body from dorsal-fin base to anal-fin base beginning from area posterior to pectoral-fin insertion and continuing posteriorly to caudal-fin base. Anterior and posterior borders of body crossbands, especially in their dorsal and ventral regions, generally outlined with darker pigment than their mid-lateral regions. Crossbands on posterior head and body generally broader than respective interspaces, which are light tan to whitish. Pigmentation of both crossbands and interspaces continued onto proximal two-thirds of dorsal- and anal-fin rays. Body also with four, small, rounded white spots; the most conspicuous spot (approximately equals ED) situated on lateral line just beyond distal tips of elongated pectoral-fin rays; second largest spot (slightly smaller than ED) on dorsal margin at mid-body region; ventralmost spot on ventral body margin at base of anal-fin

rays on vertical equal with dorsalmost spot; smallest spot (smaller than pupil of eye) less conspicuous than others and located on dorsal margin of body between gill opening and tip of elongated pectoral-fin rays. Ocular-side anterior nostril uniformly brown throughout its length. Inner lining of mouth black. Inner linings of opercles and ocular-side isthmus with concentrations of pepperdot melanophores. Blind side of head and body yellowish-white. Holotype without pepperdot melanophores on blind side; paratype with small number of pepperdots on blind side along pterygiophore regions of dorsal and anal fins. Crossbands of body continued onto proximal two-thirds of dorsal and anal fins. Anteriormost dorsal-fin rays whitish on both sides. Otherwise, ocular sides of dorsal and anal fins with light-brown basal membranes and with fin rays streaked noticeably darker (and more outlined) than membranes; distal one-third of dorsal- and anal-fin rays with longitudinal dark band continuous or nearly continuous throughout entire length of fins. Blind sides of dorsal and anal fins dark-brown throughout entire lengths of fin rays and with black band on distal one-half to one-third of fin rays. Proximal one-third of ocular side of caudal fin with brown crossband basally; middle third of fin whitish; and with a black pigment band on distal one-third of caudal fin continuous with that on dorsal and anal fins. Proximal three-fourths of blind side of caudal fin off-white to yellowish; distal one-third of caudal fin on blind side with black band. Ocular-side pectoral fin uniformly dark brown, darker than crossbands on body; blind-side pectoral fin white, with very few pepperdot melanophores on fin and fin base, and without pepperdots on body region behind pectoral fin. Ocular-side pelvic fin dark brown; blind-side pelvic fin whitish.

Distribution (Fig. 2). Known from two specimens collected in tropical waters off eastern Queensland; one taken in 49 m at Trunk Reef, eastern Australia (18°23'S) and the other collected at 28 m at a site north of Cape Bowling Green (19°9'S).

Etymology. From the Latin, *oculatus*, having eyes, and *fasciatus* meaning banded; in reference to the pigment band encompassing the eyes of this species.

Comparisons. *Soleichthys oculofasciatus* is readily differentiated from *S. heterorhinos, S. nigrostriolatus, S. lineatus* and *S. multifasciatus* by its lower meristic features (45–46 vs. 48–53 total vertebrae, 79–81 vs. 85–105 dorsal-fin rays, 68 vs. 74–91 anal-fin rays and 85–86 vs. 100–124 lateral-line scales in these other species, respectively) and in its pigmentation pattern including fewer (8 vs. 17–31) body crossbands. It further differs from *S. heterorhinos, S. nigrostriolatus* and *S. multifasciatus* in having only three crossbands on its head (vs. more than five crossbands in these other species). *Soleichthys oculofasciatus* differs from *S. microcephalus* and *S. serpenpellis* in having the first elongate ocular-side pectoral-fin ray longer than the second (vs. second elongate pectoral-fin ray longer than first) and in lacking scales on the elongate pectoral-fin ray (vs. scales present). The new species differs further from both *S. microcephalus* and *S. serpenpellis* in having a longer and narrower head and longer caudal fin (compare respective data in Tables 2, 3 and 4). It is further differentiated from *S. serpenpellis* in having complete crossbands (vs. some incomplete), in having four white spots of different sizes, two of which are in vertical alignment, on its ocular surface (vs. two spots of nearly equal size and in horizontal alignment) and in lacking small, brown spots on its ocular side (vs. spots present). From *S. siammakuti* and *S. maculosus*, *S. oculofasciatus* is readily distinguished in lacking spots on the dorsal, anal, and caudal fins characteristic of these other species. *Soleichthys oculofasciatus* can also be distinguished from *S. tubiferus* because the latter species lacks crossbands in its ocular-side colour pattern.

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